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Sport Fishery Abstracts

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes.

The last number of each volume contains a list of publications screened for appropriate material. Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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Prepared in the Branch of Federal Aid
S. E. Jorgensen, Chief
Donald F. LaPointe, Editor
Geneva T. Thompson, Asst. Editor

2522. Reish, Donald J. 1959. A DISCUSSION OF THE IMPORTANCE OF THE SCREEN SIZE IN WASHING QUANTITATIVE MARINE BOTTOM SAMPLES. Ecology, Vol. 40, No. 2, pp. 307-309.

The importance of the screen opening in washing marine quantitative samples was discussed. Five samples were washed separately through a series of 11 graded Tyler screens. The data were analyzed as to biomass, number of species, number of specimens, and the appearance and disappearance of the species.

Over 90% of the biomass, number of species and number of specimens were retained on screen size 12, 20, and 60, respectively. The majority of the species appeared and disappeared by screen size 20. The results were used to determine the effectiveness of previous marine quantitative surveys. (Auth. summ.)

2523. Burt, Wayne V. 1959. OXYGEN ANOMALIES IN THE SURF NEAR COOS BAY, OREGON. Ecology, Vol. 40, No. 2, pp. 305-306.

Anomalously low oxygen concentrations are reported for the surf near the entrance to Coos Bay, Oregon. Low oxygen concentrations were found from January through May and relatively high values the rest of the year. The times when low concentrations were found do not correlate with the expected time of maximum upwelling. The low concentrations do not appear to be caused by de-oxygenated water coming out of the estuary.

It is suggested that the possibility of low oxygen concentrations in the surf must be considered as an ecological factor in the study of shore life. (Auth. summ.)

2524. Chipman, Robert K. 1959. STUDIES OF TOLERANCE OF CERTAIN FRESHWATER FISHES TO BRINE WATER FROM OIL WELLS. Ecology, Vol. 40, No. 2, pp. 299-302.

Twenty species of fish were found to be living in a pond under the influence of brine water from oil wells. Two species (Anguilla rostrata and Dorosoma cepedianum) are of marine origin; the remainder are of freshwater origin. During a period of exceptionally high salinity 10 of these species were killed. Each species is discussed separately and the highest salinity at which the species was collected is given. Six species were experimentally subjected to brine water in laboratory tanks. Data on the laboratory determined lethal limits are compared to the field data. Conclusions are made about concentrations of brine water that certain species might survive. (Auth. summ.)

2525. Gerking, Shelby D. 1959. THE RESTRICTED MOVEMENT OF FISH POPULATIONS. Biological Reviews, Vol. 34, No. 2, pp. 221-242.

At least thirty-four species of fish have restricted movements if displaced out of the breeding season or when immature. In some cases the fish are known to defend areas against intruders, and the space they occupy can be called a territory. 'Home range' is applied in cases where movement is limited but where no aggressive defense of the area is known. The lack of differentiation between the two types of behavior is due to difficulties in observing natural populations. Limited movement is characteristic of many more fishes than was recognized formerly.

Fishes recognize their surroundings and orientate themselves accordingly. They can retain impressions of the immediate environment for a considerable time. Reflex visual responses which accomplish orientation are well known, and the senses of smell and touch are also important. The relative importance of the senses in orientation has not been worked out.

Aggressive action in both the reproductive and non-reproductive periods is well established. The nip-right hierarchy has been described for many species; in some cases the hierarchy leads to the establishment of territories. Examples of both introspecies and interspecies social behavior are presented.

Twenty-one species, exclusive of those which cross a salinity boundary, are known to home, in the sense that they choose to return to a place formerly occupied instead of going to other equally likely places. Some of them return to spawning sites; others return to preferred areas if they are displaced during the non-reproductive period. There is no single motivation for the homing response, and probably no single mechanism will account for it. Homing in fishes is much more common than is generally appreciated.

The behaviour of fishes can be applied to practical problems of population density, growth and stocking. (Auth. summ.)

2526. Steele, John H. 1959. THE QUANTITATIVE ECOLOGY OF MARINE PHYTOPLANKTON. Biological Reviews, Vol. 34, No. 2, pp. 129-158.

Microscopic algae are suited for the use of mathematical techniques in population studies. These techniques require exact formulation of the basic factors, such as photosynthesis, respiration, sinking, nutrient requirements, grazing and the vertical mixing of the water. The available information is, however, vague and often contradictory. Yet simple mathematical models with a suitable choice of postulates can explain the main features of populations inhabiting a wide range of environments. The conclusion of this approach is that marine phytoplankton populations can be defined by a few simple physiological characteristics, and their general abundance in the sea is controlled by a small number of physical factors.

Looked at in this way the total population and its production of organic matter appear to be largely independent of the variations in species composition. Estimates of the plants in abstract terms, such as carbon content, provide more insight into their ecology than detailed studies of the species present in any sample. The weakness in the postulates, however, and the choice, for the detailed studies, of ecologically simple regions, make the general application of these conclusions doubtful. The work on the external metabolites of phytoplankton, although

it might be included theoretically in the bases of the models, also raises many practical and fundamental difficulties. Because of these doubts about the foundations of this type of work, phytoplankton ecology cannot yet provide links between the environment and commercial fisheries. (Auth. summ.)

2527. Raghu, Prasad R. 1959. REPRODUCTION IN CLEVELANDIA IOS (JORDAN AND GILBERT), WITH AN ACCOUNT OF THE EMBRYONIC AND LARVAL DEVELOPMENT. Proceedings of the National Institute of Sciences of India. Part B, Biological Sciences, Vol. 25, No. 1, pp. 12-30.

The paper deals with the size at first maturity, breeding habits and sexual dimorphism, embryonic development and larval stages of the goby, Clevelandia ios.

It was noticed that 23 percent of females start maturing at a standard length of 29.0 mm. The percentage increases gradually and all females 34.0 mm and above are mature. The spawning season extends over a period of 9 months with the heaviest spawning taking place from March to June. The fish lays about 750 to 1,000 eggs but actual counts of ripe ovarian ova vary from 800 to 1,200 according to the size of the fish.

There is no parental care among Clevelandia and the eggs are laid over a considerable area either singly or in small groups. Sexes can be separated easily in specimens larger than 19 mm. by the examination of the genital papilla. There is no significant difference in standard length between the two sexes, but the length of head and length of maxillary are significantly different in the males and females for a given standard length, they being greater in the males than in the females.

The embryonic development and larval stages of Clevelandia up to the tenth day after hatching have been described from eggs artificially spawned in the aquarium. At temperatures varying from 15.0 to 15.5°C. the period of incubation extends from ten to twelve days. Descriptions of post larval stages are also given. Attempts to rear the larvae in the laboratory for more than ten days proved to be impossible and the details of the methods tried are given. (Auth. abst.)

2528. Filice, Francis P. 1958. INVERTEBRATES FROM THE ESTUARINE PORTION OF SAN FRANCISCO BAY AND SOME FACTORS INFLUENCING THEIR DISTRIBUTIONS. The Wasmann Journal of Biology, Vol. 16, No. 2, pp. 159-211.

Between Point San Pablo and the Antioch Bridge, in the estuarine portion of San Francisco Bay, 460 stations were set up at which bottom samples and physical data were taken. The following conclusions are based on these data.

The fauna is derived from the shallow water subtidal fauna of the California coast. Each species is usually represented by only a few specimens in any given area. There is no correlation between the distribution of any species and differences in pH or oxygen content of the surface waters in the estuary.

The salinity gradient has a strong effect on the species distribution. The number of species represented in the substrate decreases as one travels toward the fresh water source.

Five species have an unusual response to the salinity gradient. The remaining species break into two groups at Carquinez Straits. The region of overlap is at a salinity of 9.5 o/oo. The riverward fauna contains species that are fresh-water, estuarine, and marine in habit; the seaward fauna is made up of estuarine and marine forms.

The type of substrate influences the distribution of many species but not profoundly enough to explain the presence of the different contingents in the two faunas. For example, marine forms are present in the riverward fauna in spite of the lack of their preferred substrates.

The depth in the estuary exerts an influence on the species distribution. This influence was not correlated with bottom type stratification. Those species found at all depths were present in fewer than expected numbers in the intertidal parts of their ranges. Evidence is presented that the marine species are found at deeper levels than those from other habitats; apparently to take advantage of the higher and more stable salinity conditions at these levels. It is on the basis of this evidence that the various contingents in the two faunas are explained.

Evidence is presented that shows the hydrobiological environment in the study area has changed very little in the past 40 years. (From auth. summ.)

2529. Moran, P. A. P. 1959. THE THEORY OF SOME GENETICAL EFFECTS OF POPULATION SUBDIVISION. Australian Journal of Biological Sciences, Vol. 12, No. 2, pp. 109-116.

The genetical effects of the subdivision of a population into partially isolated subgroups are considered in two particular cases. In the first, a probability model is studied in which the subpopulations are of finite size with migration between them. In the absence of selection the asymptotic rate of progress of homozygosity is shown to be very little affected by the subdivision. In the second case a deterministic model is studied in which there are two subpopulations in which selective forces are equal and opposite. A stable dimorphism is then shown to exist if there is any small amount of intermigration. (Auth. summ.)

2530. Day, Alan A. 1959. THE CONTINENTAL MARGIN BETWEEN BRITTANY AND IRELAND. Deep-Sea Research, Vol. 5, No. 4, pp. 249-265.

The continental slope between Brittany and Ireland is steep and cut by many canyons, with the exception of the central region which forms a broad smooth spur. Scarps up to 110 miles in length are associated with the continental margin, and these, together with the steep areas of the slope proper are considered very probably to have been developed by faulting. Cores and bottom samples from the area are shown mainly to represent Recent and Pleistocene deposits, with the exception of three which represent Tertiary and possibly Cretaceous strata.

New names applied to topographic features in

the area are: Meriadzek Terrace, Goban Spur, and Pendragon Scarp. (Auth. abst.)

2531. Northrop, John, Maurice Blaik, and Roberto Frassetto. 1959. BATHYMETRY OF THE GIBBS HILL AREA, BERMUDA. Deep Sea Research, Vol. 5, No. 4, pp. 290-296.

Precision depth recordings were made South of Gibbs Hill, Bermuda, along a number of closely spaced sounding tracts. The accuracy of transit navigation and the sounding coverage were considered sufficient to justify correcting the soundings for both sound velocity and slope. The corrected soundings show that a steep sided submarine spur extends south-south-east from the shelf break off Gibbs Hill. The spur has a topographic relief of 300 fm and is about 3 miles long and 1/2 mile wide. At the 1000 fm curve, the feature broadens into a platform that extends another 12 miles seaward to the 2000 fm curve. True slopes along the steep portion of the spur are as high as 50° and the bottom echoes appear to be from a number of highlights causing "crescents" on the record. Where a definite break in slope occurs, the apparent bottom shown on the bathygram is that of a diffraction pattern from an edge and all points on this crescent migrate to a point, which is the true position of the break in slope. (Auth. abst.)

2532. Worthington, L. V. 1959. THE 18° WATER IN THE SARGASSO SEA. Deep-Sea Research, Vol. 5, No. 4, pp. 297-305.

The surface waters of the northern Sargasso Sea cool to a temperature of about 18°C each winter, forming an isothermal layer more than 350 m deep. This layer is also isohaline at 36.5 °/oo. Much water with these characteristics is converged in this area and flows off to the south at the 300 m level. The excess of "18° water" formed each winter immediately south of the Gulf Stream can be clearly detected throughout the Sargasso Sea, at least as far south as the 20th parallel North. Some of the implications of this are discussed. (Auth. abst.)

2533. Folsom, T. R., F. D. Jennings, and R. A. Schwartzlose. 1959. EFFECT OF PRESSURE UPON THE "PROTECTED" OCEANOGRAPHIC REVERSING THERMOMETER. Deep-Sea Research, Vol. 5, No. 4, pp. 306-309.

Actual degree of protection offered by the shell of the usual "protected" reversing thermometer has been computed. It appears that in the average modern instrument errors of roughly 0.002°C per 1,000 m sea depth change can be expected. However, certain protected instruments having an exceptionally small air volume below the cork have been found to be influenced by external pressure changes to as much as 0.008°C per 1,000 m, particularly at great sea depths. (Auth. intro.)

2534. Hobbs, Horton H., and C. W. Hart, Jr. 1959. THE FRESHWATER DECAPOD CRUSTACEANS OF THE APALACHICOLA DRAINAGE SYSTEM IN FLORIDA, SOUTHERN ALABAMA, AND GEORGIA. Bulletin of the Florida State Museum, Biological Sciences, Vol. 4, No. 5, pp. 145-192.

Two families of freshwater decapod crustaceans frequent the lower Apalachicola drainage system. The family Palaemonidae is represented by 2 shrimps of the genus Palaemonetes and the Astacidae by 21 crayfishes belonging to the genera Procambarus (15 species), Cambarus (4), Orconectes (1), and Cambarellus (1). An illustrated key is provided for identifying these animals, and a tabular summary of their ecological distributions precedes an annotated list of species. The latter includes for each species a bibliographic synonomy, diagnostic characters, color notes, ecological data, range, life history notes, and a list of crayfish associates. Locality records in the area are indicated on appended maps. Procambarus rogersi expletus, new subspecies, is described from Calhoun County, Florida. (Auth. synopsis)

2535. Hart, C. W., Jr. 1959. THE OSTRACODS OF THE GENUS ENTOCYTHERE FROM THE LOWER CHATTAHOOCHEE-FLINT BASIN: WITH A REVIEW OF THE OCCURRENCE OF THE GENUS IN FLORIDA, AND DESCRIPTIONS OF TWO NEW SPECIES. Bulletin of the Florida State Museum, Biological Sciences, Vol. 4, No. 6, pp. 193-205.

During a systematic survey of the flora and fauna of the Apalachicola River drainage area supported by the National Park Service and the National Science Foundation, those ostracods epizoic on crayfishes were studied. A key to the known species of entocytherid ostracods found in Florida and the lower Chattahoochee-Flint basin, a survey of the ranges of these ostracods, a list of their crayfish "hosts," and descriptions of two new ostracod species are included. The new species, Entocythere geophila and E. torreya, are placed in a new group, the Geophila Group, which is here designated. (Auth. synopsis)

2536. Jannasch, Holger W., and Galen E. Jones. 1959. BACTERIAL POPULATIONS IN SEA WATER AS DETERMINED BY DIFFERENT METHODS OF ENUMERATION. Limnology and Oceanography, Vol. 4, No. 2, pp. 128-139.

Five different cultural and two direct microscopic methods were employed for estimating the abundance of bacteria in samples of sea water collected from both oceanic and neritic areas. The cultural methods included macrocolony counts on nutrient agar, silica gel, and membrane filters, microcolony counts on membrane filters, and the extinction dilution method. Direct microscopic counts were made of microbes on membrane filters and of microbes transferred from membrane filters to glass slides. Direct counts showed the presence of from 13 to 9,700 times as many bacteria as cultural methods. The extinction dilution method and the microcolony membrane filter method gave counts 20 and 35 times higher, respectively, than did any of the macrocolony methods. Direct microscopic counts on membrane filters were approximately 150 times higher than plate counts, and the numbers of microbes transferred from membrane

filters to glass slides were approximately 2,000 times higher than plate counts. In all of the cultural methods, a peptone-yeast extract medium was used.

Differences in the abundance of microorganisms obtained by the various methods are attributed to a variety of factors: the presence of bacteria in aggregates, selective effects of the media, and the presence of inactive cells. A marked decrease in bacterial numbers was observed just below the thermocline as reflected in the macrocolony methods but not by the direct microscopic methods. A considerable population of spirilli-like forms was noticed directly under the microscope but not after cultivation. (Auth. abst.)

2537. McHugh, J. L., R. T. Oglesby, and A. L. Pacheco. 1959. LENGTH, WEIGHT, AND AGE COMPOSITION OF THE MENHADEN CATCH IN VIRGINIA WATERS. Limnology and Oceanography, Vol. 4, No. 2, pp. 145-162.

Major features of life history of menhaden (Brevoortia tyrannus) were deduced by examination of samples from commercial purse-seine and pound-net fisheries, and collections made by plankton nets, gill nets, and otter trawls. Menhaden are present in Virginia waters throughout the year. Spawning probably takes place in the ocean, and young move into Chesapeake Bay and its estuaries soon after hatching. As they grow, they move back down the estuaries toward the sea, so that, in most seasons, mean sizes of fish are progressively greater in a seaward direction. Few fish older than three years are taken in the commercial fisheries. The purse-seine fishery takes about 98 percent of the total catch, operates from May to October and exploits primarily fish in their third year of life in spring and early summer, and fish in their second year in late summer and fall. The pound-net fishery takes principally fish in their second year in spring and early summer, and fish in their first year in late summer and fall. Prior sampling by the pound-net fishery offers a method of forecasting purse-seine catches at least a year in advance. Ages of menhaden up to the end of the third year of life may be determined by the length-frequency method or by reading scales. Validity of the scale method has been established, and there is evidence that two groups of fish, characterized by their size at the time of formation of the first annulus, enter the Virginia fishery. Mean lengths at the end of each calendar year of life are approximately 125,000, and 230 mm. Mean weights are about 30, 130, and 200g. Spawning in the Chesapeake region probably is most intense in late fall and the following spring, associated with seasonal waves of emigration from and immigration to Chesapeake Bay. In this region maturity is reached at about one and one-half years of age. (Auth. abst.)

2538. Clarke, David B., and Reid A. Bryson. 1959. AN INVESTIGATION OF THE CIRCULATION OVER SECOND POINT BAR, LAKE MENDOTA. Limnology and Oceanography, Vol. 4, No. 2, pp. 140-144

The flow of water in the middle and surface layers around and over a lake bar was examined in terms of horizontal and vertical velocities, and divergence. These quantities were mapped and the patterns correlated with the general current velocity, wind conditions, and obstruction by the bar.

The bar caused two types of flow around it. In the unstratified layer above the thermocline the flow continued right over the bar, although the exact pattern of motion depended upon the current speed and the geography of the bar. In the thermocline there was a strong tendency for the water to flow around the bar, although considerable upwelling and sinking of the layer occurred. Helical rotors appeared on either side of the bar.

Internally consistent and detailed patterns of circulation were observed on a small scale without excessive expenditure of time or money. (Auth. abst.)

2539. Wohlschlag, Donald E., and Rogelio O. Juliano. 1959. SEASONAL CHANGES IN BLUEGILL METABOLISM. Limnology and Oceanography, Vol. 4, No. 2, pp. 195-209.

A one-year study of bluegill metabolism in a California reservoir indicated that field determinations of oxygen uptake rates and multivariate analyses of results with respect to weight, activity, and temperature during each season were feasible in the form,

$$Y_e = \text{constant} + b_1X_1 + b_2X_2 + b_3X_3,$$

where Y_e is the expected log milligrams of oxygen consumed per hour, X_1 is the log weight in grams, X_2 is the swimming velocity in meters per minute, X_3 is the temperature in degrees centigrade, and where b_1, b_2, and b_3 are the respective partial regression coefficients. By delimiting "seasons" on the basis of thermal and related limnological characteristics, the data yield the equations:

$$\text{Apr.-June } Y_e = -0.6954 + 0.8036X_1 + 0.0250X_2 + 0.0069X_3$$

$$\text{July-Aug. } Y_e = -2.1951 + 1.0621X_1 + 0.0138X_2 + 0.0567X_3$$

$$\text{Sept.-Dec. } Y_e = 0.9242 + 0.8494X_1 + 0.0142X_2 + 0.0198X_3$$

$$\text{Jan.-Feb. } Y_e = -1.9310 + 0.8624X_1 + 0.0427X_2 + 0.1153X_3$$

The multiple correlation coefficients for these equations are highly significant as are all the partial regression coefficients, excepting the low spring $b_3 = 0.0069$.

The weight relationships expressed by b_1 are remarkably close to Krogh's constant of approximately 0.85 except in the summer when the calculated higher rate may be due to the spawning condition of the larger fish and the post-spawning condition of the smaller fish.

There are similar relationships of respiratory rates with respect to swimming movements over the spring, summer, and autumn seasons, but during winter it appears that relatively higher oxygen consumption is required for comparable swimming activity.

The respiratory rates with respect to tempera-

ture appear to be of the same order during spring and autumn when they are lower than in summer and much lower than in winter. The high respiration-temperature regressions in winter, and possibly in summer, may be due to excessive spontaneous activity not reflected as swimming motion at temperature extremes.

Females during each season have higher metabolic rates than the males over the range of temperatures and activities encountered, but the differences are not statistically significant.

Groups of fish during the spawning season have higher than average respiratory rates than do single fish, other conditions being equal. Limited data suggest that social facilitation exists during the summer after spawning.

Variations in Felt Lake limnological conditions are considered from the standpoint of about a 50 percent reduction in volume from spring to autumn, the absence of a well developed littoral zone, and the rather drastic spring to autumn and winter declines in bottom fauna and average weights of the larger fish. A comparison of the above regressions over average spring and autumn conditions reveals that metabolic rates would be about equal, although in spring the fish grow rapidly and spawn, while in autumn and winter they lose weight. Similarly the calculated winter metabolic rates are higher at comparable temperatures than those of spring or autumn due possibly to cold adaptation.

While the potential growing season in Felt Lake would be about twice as long as that for the northern portion of the native bluegill range, the growth rates are of the same order. The biological productivity of the bluegill in Felt Lake and similar western U. S. waters is interpreted to be much poorer than in eastern areas because of the longer growing season without adequate food (especially bottom fauna) production and because there appears to be no adaptive mechanism for lowering the metabolic requirements during seasons of poor food supplies. (Auth. abst.)

2540. Kanwisher, John. 1959. POLAROGRAPHIC OXYGEN ELECTRODE. Limnology and Oceanography, Vol. 4, No. 2, pp. 210-217.

A method has been developed for the continuous monitoring of oxygen tension in solutions and gases. The oxygen is reduced at a platinum surface which is covered with a plastic membrane. The silver-silver oxide reference electrode is also included under the membrane. Drift is less than 10 percent for a period of days, and temperature compensation is possible. A number of uses to which it has been put are described. (Auth. abst.)

2541. Itazawa, Yasuo. 1959. INFLUENCE OF TEMPERATURE ON THE NUMBER OF VERTEBRAE IN FISH. Nature, Vol. 183, No. 4672, pp. 1408-1409.

Eggs of Channa argus (Cantor) were reared at different constant temperatures. This was repeated three times utilizing eggs from three different pairs of fish. Results show that an intermediate temperature produces a lower average number of vertebrae than either high or low temperature; genetic factors seem to have more effect on vertebral number than environmental ones. The finding does not coincide with the generally accepted view but does support results of Taning's work on Salmo trutta trutta and Lindsey's Macropodus operculus.

2542. Latta, William C. 1959. SIGNIFICANCE OF TRAP-NET SELECTIVITY IN ESTIMATING FISH POPULATION STATISTICS. Papers of the Michigan Academy of Science, Arts, and Letters, Volume XLIV, Part I. Natural Science, pp. 123-138.

The trap net used in these studies, a commercial type, has a single pot 5 feet by 3 feet by 8 feet, with 2-inch stretched mesh. The heart is 12 1/2 feet long with 2 1/2-inch mesh; and the wings are 10 feet long with 3-inch mesh. The lead is 150 feet long by 3 feet deep with 3-inch mesh.

There is no doubt that these trap nets are selective for the larger fish of a size class above the minimum size imposed by the physical dimensions of the net. In all probability this selectivity can be attributed to the behavior of the fish. The procedure developed in Michigan of randomly selecting numerous netting stations in a lake and moving the nets daily has ensured, probably better than any other approach, that the sample will reflect the true proportion of marked to unmarked fish in the lake. Then an estimate based on size classes corrects for the variation in reaction of the fish to the nets that may be associated with size.

It is essential in the estimating of population statistics that consideration be given to the selectivity of the fishing gear and that this be corrected for the variation in the final analysis. To quote D. B. DeLury, commenting on estimates of animal populations, "All of our theory is developed, implicitly or explicitly, on the assumption that sampling is random." At the present time the attainment of a random sample of a natural population appears as almost impossible, but the goal must be kept in mind, and such things as the consideration of the behavior of fish to the fishing gear not neglected. (Auth. concl.)

2543. Mansfield, W. W. 1959. THE INFLUENCE OF MONOLAYERS ON EVAPORATION FROM WATER STORAGES. III. THE ACTION OF WIND, WAVE, AND DUST UPON MONOLAYERS. Australian Journal of Applied Science, Vol. 10, No. 1, pp. 73-84.

The nature of the ravages of wind, wave, and dust upon monolayers spread upon exposed surfaces of water are examined and some estimates are made of the resulting average losses of material from a monolayer of cetyl alcohol. (Auth. summ.)

2544. Mansfield, W. W. 1959. THE INFLUENCE OF MONOLAYERS ON EVAPORATION FROM WATER STORAGES. II. EVAPORATION AND SEEPAGE FROM WATER STORAGES. Australian Journal of Applied Science, Vol. 10, No. 1, pp. 65-72.

The influence of depth of water upon the annual

evaporative cycle of a water storage is estimated. The relations between storage evaporation and losses from an evaporimeter are outlined.

It is shown that seepage losses from a storage may be determined from variations in its total chloride ion content. (Auth. summ.)

2545. Kuroki, Toshiro. 1959. FUNDAMENTAL STUDIES ON THE RELATIONS BETWEEN UNDER-WATER SOUND AND FISH BEHAVIOUR (III)---ABOUT THE ECHOLESS-WALL OF AQUARIUM---. Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 7, pp. 102-105. (In Japanese with English abstract)

In this paper, the author describes the results of experiments on the reflection and penetration of underwater sound and its absorption by a special liquid layer, carbon disulfide.

Because underwater sound is absorbed by internal walls of 20 cm (thickness) CS_2-layer, a 1 m cubic aquarium is equivalent to 120 m cubic water space. These studies provide a means for experimenting on the auditory characteristics of fish in small aquarium. (From auth. abst.)

2546. Saito, Kaname. 1959. BIOCHEMICAL STUDIES ON THE FISH BLOOD-XIV. ON THE MEAN CORPUSCULAR CONSTANT AND SHAPE OF RED CORPUSCULE. Memoirs of the Faculty of Fisheries, Kagoshima University, Vol. 7, pp. 192-198. (In Japanese with English abstract)

The variety in size and shape of red corpuscles was observed to be constant in each species. Generally, the large-type red corpuscle was oblong and the small one was round in every fish species.

In general, the mean corpuscular volume of fish is higher than that of man. The mean volume of sharks, rays, and other elasmobranchs is far higher than that of teleosts. Migratory fish such as bonito or albacore had lower values than other fish. It was also found that the larger the mean corpuscular volume the larger the mean corpuscular hemoglobin concentration, and generally the larger the mean corpuscular hemoglobin concentration the lower the number of small red corpuscles.

The mean corpuscular hemoglobin concentration of fish is lower than that of man, and generally is lower in elasmobranchs than in teleosts. (From auth. abst.)

2547. Anraku, Masateru. 1956. SOME EXPERIMENTS ON THE VARIABILITY OF HORIZONTAL PLANKTON HAULS AND ON THE HORIZONTAL DISTRIBUTION OF PLANKTON IN A LIMITED AREA. Bull. Fac. Fish., Hokkaido University, Vol. 7, No. 1, pp. 1-16; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12715. 1959.

The variability of catches caught by 2 models of the Handy Underway Plankton Catchers was examined statistically by 3 series of experiments. The percentage standard deviations of a single observation for the small catcher (Model I) are calculated as 55.6%, 163.5% and 57.1%, and those of the large catcher (Model II) are 78.6%, 85.2% and 57.3%. The order of deviations of both catchers is roughly the same, and the values are not greater than those previously reported for horizontal tows of Hardy Indicator or ordinary plankton net. The mean ratios of catches of both catchers and 3 standard deviation limits of these values are obtained as 3.03 (1.30 - 7.08), 4.31 (1.73 - 10.72) and 2.73 (1.67 - 4.47); the ratio of the areas of openings in the head-piece between 2 catchers is 6.25. Thus, the amount of catch taken by the large catcher is not always proportional to that of the small one. The difference of the proportion of each organism caught with the 2 catchers over the tows indicates the differential selection of organisms with the type of machines. The 20-minute horizontal tow with 130 cm stramin fish-larva net at low speed does not show a significantly different mean value of catches as compared with that of 10-minute tow with identical net. It is found that the approximate mean value of population of fish eggs and larvae is satisfactorily represented by the 10-minute tow. However, the percentage standard deviation of a single observation for catches in prolonged tow (20 minutes) with such net is about one-half that of the short time tow (10 minutes). The 20-minute tow usually can sample certain species that have not occurred in the 10-minute tow, but in some cases some of the species caught by the 10-minute tow are not found in the collection of the 20-minute tow. A preliminary experiment on the horizontal distribution of plankton in a limited area was made by means of a hand pump method in which the amount of water sampled is accurately estimated. There was a certain extent of variability of catches similar to the case of net haul; this variability should involve other causes, more probably a non-random distribution of organisms themselves, rather than any technical error in the operation, which was well eliminated in the pumping method. (Auth. summ.)

2548. Redfield, A. C. 1958. THE BIOLOGICAL CONTROL OF CHEMICAL FACTORS IN THE ENVIRONMENT. Amer. Scientist, Vol. 46, No. 3, pp. 205-221; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12730. 1959.

The proportions in which certain elements enter into the biochemical cycle in the sea, and their relative availability in the water are discussed. It is suggested that the nitrate present in sea water and the O_2 of the atmosphere have been produced in large part by organic activity. The production or organic matter in the sea is due to the photosynthetic activity of microscopic floating plants and is limited to the surface layers where sufficient light is available. The autotrophic zone has a depth of approximately 200 m and includes less than 5% of the volume of the ocean. Below this zone, life depends on organic matter carried down by organisms sinking from above or by the vertical migrations of animals. The analysis of many samples of plankton taken in a variety of places indicates that the atoms of P, N, and C are present on the average in the ratios of 1:16:106. In comparison, sea water collected from various depths shows the available

P, N, and C in ratios of 1:15:105 and that about 235 atoms of O_2 disappear for each addition of 1 P atom. It seems that the biochemical cycle in the sea may have produced the major amount of O_2 in the atmosphere and that conditions in the sea have adjusted its level to that which occurs at present. (H. J. C.)

2549. Jarnefelt, H. 1956. LIMNOLOGICAL SURVEY OF SOME FINNISH LAKES. XVI. (ZUR LIMNOLOGIE EINIGER GEWASSER FINNLANDS. XVI.) Ann. Zool. Soc. Zool. Bot. Fennicae "Vanamo", Vol. 17, No. 1, p. 261; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12747. 1959.

Survey of the limnological status of 331 Finnish lakes, with lists of common organisms encountered in each lake and discussion of the significance of difference of species composition and abundance relations in classifying the lakes according to their productivity. (E. P.)

2550. Jarnefelt, H. 1956. LIMNOLOGICAL SURVEY OF SOME FINNISH LAKES. XVII. (ZUR LIMNOLOGIE EINIGER GEWASSER FINNLANDS. XVII.) Ann. Zool. Soc. Zool. Bot. Fennicae "Vanamo", Vol. 18, No. 2, pp. 1-61; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12748. 1959.

A limnological description of 2 arctic lakes of Finnish Lapland, and 2 lakes of central Finland, including detailed lists of the organisms observed and their abundance relations, as well as data on environmental conditions existing in these lakes. (E. P.)

2551. Kuchar, Karl Wilhelm. 1957. INFLUENCE OF BACTERIA ON OXYGEN DISTRIBUTION IN SMALL BODIES OF WATER. (UNTERSUCHUNGEN UBER DEN EINFLUSS DER BAKTERIEN AUF DIE SAUERSTOFFSCHICHTUNG IN KLEINGEWASSERN. Sydowia, Vol. 11, No. 1/6, pp. 327-336; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12749. 1959.

In small bodies of water investigated for O_2 distribution, stratification was found to be totally unrelated to the O_2 level. The homogeneous distribution of O_2 in unstratified water remained unchanged even when strong bacterial development was observed; such localities are neither favorable nor unfavorable to aerobic or anaerobic activity. (From auth. summ.)

2552. Laird, Marshall. 1958. A SECONDARY EFFECT OF DDT UPON THE AQUATIC MICROFLORA AND MICROFAUNA. Canadian Jour. Microbiol., Vol. 4, No. 5, pp. 445-452; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12750. 1959.

Observations were made on the microflora and microfauna of infusions in which larvae of Anopheles maculipennis atroparvus were being subjected to DDT selection pressure (2 μg/ml). Comparisons with controls indicated that the insecticide influenced neither the species representation nor the succession of the organisms concerned. However, heavy initial larval mortality took place. Dead larvae remaining in the containers overnight became centers of very rapid bacterial multiplication, and the maturation of the experimental infusions was accelerated. The larval cultures became polysaprobic after about 2 weeks, by which time the surviving larvae were in the 4th instar. These survivors were large and healthy, having spent their early developmental period in the presence of a rich supply of infusion organisms answering their food requirements, and successfully withstood the deteriorating environmental conditions and consequent heavy infestation with epibionts (Chlamydobacteriales and peritrichous ciliates). On the other hand, 4th instar larvae from similar infusions in the laboratory colony of A. m. atroparvus were often undersized and sickly because of early overcrowding linked with the initially longer time required for the development of an adequate yield of food organisms. Such larvae, also pupae, frequently died of exhaustion due to undernourishment and complicated by the hampering of their activity by a vestiture of bacteria and ciliates. This explained the paradox that adults derived from the laboratory colony tended to be less robust than those hatching from developmental stages subjected to DDT selection pressure. Besides pointing to the importance of paying due regard to larval environmental factors in resistance studies, these observations suggest the need for field investigations of the significance of similar chains of events in nature. (Auth. abst.)

2553. Ludzack, F. J., W. M. Ingram, and M. B. Ettinger. 1957. CHARACTERISTICS OF A STREAM COMPOSED OF OIL REFINERY AND ACTIVATED SLUDGE EFFLUENTS. Sewage and Indust. Wastes, Vol. 49, No. 10, pp. 1177-1189; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12751. 1959.

Authors report on field studies of the Ottawa River during low flow periods when stream consisted primarily of municipal activated sludge sewage treatment effluent, refinery and petrochemical plant effluents. Primary pollutional effect was deposition of oily sludge resulting from rapid separation of emulsified oil from effluents entering the stream. Recovery as evidenced by improved water clarity, absence of surface oil, odor, and sludge decomposition generally occurred within 8 miles (1.2 days river travel time). Laboratory studies of deposited sludge decomposition showed insignificant anaerobic decomposition of hydrocarbons present. Aerobic decomposition of emulsified oil occurred at a rate of 50 to 80%/week at summer temperatures. (I. G.)

2554. Lueck, B. F. 1957. DETERMINATION OF STREAM PURIFICATION CAPACITY. Sewage and Indust. Wastes, Vol. 29, No. 9, pp. 1054-1065; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12752. 1959.

Studies of self-purification phenomena on several Wisconsin streams led to development of several new parameters of stream organic loading and purification capacity. Permissible loadings based on O_2 removal were found to vary from 13 to 20 lbs 5-day

BOD daily per cfs per ppm DO (dissolved D_2 removed at temperatures from 24 to 11°C. In heavily-loaded flowing streams, purification capacity was found to range from 400 to 4000 lbs. ultimate BOD daily per 1000 cfs per mile. In heavily-loaded impounded waters, maximum purification capacity may approach 40,000 lbs. ultimate BOD daily per 1000 cfs per mile. (I.G.)

2555. Maeda, Hiroshi. 1955. CLASSIFICATION OF PHYTOPLANKTON COMMUNITIES AND RELATION BETWEEN COMMUNITIES AND WATER MASSES. Jour. Shimonoseki Coll. Fish., Vol. 4, No. 3, pp. 301-310; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12753. 1959.

The individual or cell numbers of plankton in water samples of 11 obtained at the observation of May 10-12, 1950 are shown. By using Motomura's correlation coefficient method, the phytoplankton communities are classified into the following 3 types: upper layer type, stagnant layer type and intermediate one. Samples obtained from the southwestern part of the lagoon, St. 6, the area near openings of channels and the deeper part of the upper layer, show the plankton composition in a faded state of the community naturally suggested by the chemical characteristics of the water. (Auth. summ.)

2556. Rand, M. C. 1957. CONCEPTS OF SURFACE REAERATION. A CRITICAL REVIEW. Sewage and Indust. Wastes, Vol. 29, No. 11, pp. 1282-1300; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12755. 1959.

Ability of atmospheric O_2 to dissolve in natural water bodies is of primary importance in determining the self-purification capacity of any stream. Various mathematical and physical formulas have been advanced for estimation of this property, including the 1st-order reaction, Fick's law of hydrodiffusion, the 2-film theory of gas transfer, and Pasveer's diffusion formulas, and each are discussed critically. The importance of water turbulence, temperature, and presence of other solutes is also considered. (I.G.)

2557. Saisyo, Toshio. 1955. SEASONAL CHANGE OF PLANKTON DIATOMS IN KOGOSHIMA BAY. (In Japanese with English summary.) Mem. Fac. Fish. Kagoshima Univ., No. 4, pp. 113-118; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12756. 1959.

Oceanographical and planktological observations in Kagoshima Bay were carried out monthly for one year beginning April 1953 and occupying 26 stations. Sampling was made by vertical hauling of 0-50 m layer. The net was made of bolting silk XX No. 13, measuring 22.5 cm in mouth diameter. The catch was left standing in the laboratory and the settling volume was measured. Since the proportion of diatom volume is far greater than that of other plankton constituents, the seasonal change of settling volume of total plankton generally corresponds to the change of diatom population. This is not the case in December and January, since in these months Noctiluca increased markedly, and occurrence of diatoms and other plankton forms occurred very sparsely. In April, as the water temperature rose, Nitzschia seriata became extremely abundant, while very few of them were found in June. Largest growth of diatoms was observed in July and August, although the species were not so numerous. In October and November, when water temperature was going down, the total quantity of plankton as well as diatoms decreased, while the number of diatom species was found most abundantly in this season.

2558. Enami, Sumio, and Toyotake Tanque. 1954. ON THE FISHERIES OF TUNA AND THE OCEANOGRAPHICAL CONDITIONS IN THE SAWU SEA. (In Japanese with English summary.) Mem. Fac. Fish. Kagoshima Univ., Vol. 3, No. 2, pp. 1-8; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12771. 1959.

Catch/100 hooks amounted to 6.4 fish of all species in summer, and 7.4 in winter. Species taken were yellowfin and big-eye tuna, swordfish and sharks. In the case of yellowfin tuna, their percentage by number, of all kinds of fish caught in winter, was 52.5%; for big-eyed tuna was 16.7%. In summer yellowfin was 63.9% and big-eye was 2.3%. The body length composition of yellowfin tuna showed a range of 100-160 cm; the most usual size was 130-150 cm; a greater number of large-sized fish was found in summer than in winter. The sex composition of yellowfin tuna catches was about 69.2% males in winter; 57.1% in summer. Almost all the fish caught in both seasons were found to be nearly ripe. The optimum temperature for catch was found to be 20°-23°C in winter; and 23°-25°C in summer. Oceanographical and astronomical conditions in winter and in summer were of different types; these were quite intimately related with fishing conditions. (Auth. summ.)

2559. Prasad, R. R. 1958. A NOTE ON THE OCCURRENCE AND FEEDING HABITS OF NOCTILUCA AND THEIR EFFECTS ON THE PLANKTON COMMUNITY AND FISHERIES. Proc. Indian Acad. Sci., Sect. B, Vol. 47, No. 6, pp. 331-337; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12791. 1959.

Effects of Noctiluca swarms on Fisheries are more adverse than beneficial. Swarming takes place only when the sea is calm and there is an abundant supply of diatoms, the outbursts usually being preceded by diatom blooms. Noctiluca feed on several species of diatoms and to a very small extent on some of the smaller zooplankters. The presence of a large number of Noctiluca in an area seems to exclude other zooplankters, particularly the copepods. The rapid grazing-down of diatoms and exclusion of other zooplankters result in an almost monospecific population of these obnoxious cystoflagellates. Such a plankton adversely affects the important fisheries for sardines, anchovies, mackerel, etc., as these fishes do not occur in the presence of Noctiluca swarms. The negative indication continues as long as the swarms persist but transient swarms do not

seriously affect either the plankton community or fisheries. (From auth. summ.)

2560. Twomey, Eileen. 1957. SALMON OF THE RIVER SHANNON (1952-56). Jour. Conseil Perm. Internatl. Explor. Mer., Vol. 23, No. 1, pp. 89-96; Biological Abstracts, Vol. 33, No. 4, Abst. No. 12809. 1959.

A continuation of studies of the year-classes based on scale-readings for the period covered. (N. W. R.)

2561. Mitani, F. 1958. STUDIES ON THE MATURITY AND SPAWNING OF THE YELLOW TAIL, SERIOLA QUINQUERADIATA T. ET S., FOUND IN THE JAPANESE WATERS AND THEIR ADJACENT REGIONS. I. BILATERAL ASYMMETRY OF GONAD AND MATURITY GRADE. Japanese Jour. Ecol., Vol. 8, No. 1, pp. 7-11; Biological Abstracts, Vol. 33, No. 4, Abst. No. 13529. 1959.

The left lobe of the fish gonad is usually better developed than the right one except in a few species, whenever a fish has a pair of bilaterally asymmetrical gonads. The yellow tail is an example with a dextrous gonad. A new form of the maturity index, a gonad index and coefficient, is given, which may be more convenient and rational than those presented by previous workers. (R. T.)

2562. Irie, Takaaki. 1957. ON THE FORMING SEASON OF ANNUAL RINGS (OPAQUE AND TRANSLUCENT ZONES) IN THE OTOLITHS OF SEVERAL MARINE TELEOSTS. Jour. Fac. Fish. and Animal Husbandry, Hiroshima Univ., Vol. 1, No. 3, pp. 311-319; Biological Abstracts, Vol. 33, No. 4, Abst. No. 13682. 1959.

The forming season of annual rings, i.e., translucent and opaque zones, in the otoliths of marine teleosts Argyrosomus, Lateolabrax and Mylio caught in the Inland Sea of Seto and Pseudosciaena caught in the East China Sea, are as follows: Translucent zones are formed generally from summer to autumn, and opaque ones from winter to spring of the next year. Accordingly, calcium carbonate is deposited abundantly on the surface of otolith during summer and autumn, while it is scantily deposited during winter and spring. The translucent and opaque zones in the otolith of Argyrosomus, Lateolabrax and Mylio can be used for estimation of age. The zones of Pseudosciaena must be used carefully for this purpose. The status of the formation of the annual rings is different between Pseudosciaena in the East China Sea and the others in the Inland Sea of Seto. (Auth. summ.)

2563. Zotin, A. I. 1958. THE MECHANISM OF HARDENING OF THE SALMONID EGG MEMBRANE AFTER FERTILIZATION OR SPONTANEOUS ACTIVATION. Jour. Embryol. and Exptl. Morphol., Vol. 6, No. 4, pp. 546-568; Biological Abstracts, Vol. 33, No. 4, Abst. No. 14288. 1959.

Unfertilized eggs of the trout (Salmo trutta m. lacustris Linn.) and of salmon (S. salar m. sebago Girard) can resist a pressure of 160-280 g (toughness of the membrane is 1500-2000g/cm^2) and whitefish egg (Coregonus lavaretus baeri n. swirensis Pravdin) 40-50 g. Following fertilization or activation the membrane toughness first decreases. During this period the trout and salmon eggs can resist a pressure of 60-210 g, and whitefish eggs 20 g. After 60-120 minutes the toughness of the trout and salmon membrane, and after 120-180 minutes that of the whitefish membrane, begins to rise at a high rate attaining its maximum after 3-7 days in the trout and salmon, and after 1-2 days in the whitefish. At this time trout and salmon eggs can resist a pressure as high as 2500-3500 g (membrane toughness 19,000-21,000 g/cm^2) and those of the whitefish 1800-2200 g. Following fertilization or activation a special enzyme is released from the egg surface which calls forth hardening of the membranes. The release of the enzyme is blocked by 0.1 N LiCl, NaCl, $CaCl_2$ $MgCl_2$, $AlCl_3$, and is stimulated by water, in the medium. The release of the hardening enzyme from the egg surface is independent of secretion of those substances which cause the formation of the perivitelline space. The hardening enzyme is unstable, being inactivated by 5 minute heating at 30°C. The effect of the enzyme upon the membranes is only necessary during the first 6-7 minutes following fertilization, whereupon hardening progresses equally well in its absence. Ca/ions are necessary for the accomplishment of the enzyme action. The course of further hardening after enzyme action can be divided into three stages, viz. a preparatory period when membrane toughness is somewhat decreased, a period of rapid increase in membrane toughness, and a period of maximum value with no further change. During the preparatory period 0.1 N LiCl, $AlCl_3$ and $FeCl_3$ produce an inhibitory effect while 0.1 N $CaCl_2$, $MgCl_2$ and $SrCl_2$ accelerate the hardening process. The passage of water across the membrane during the formation of the perivitelline space within the 1st 25-30 minutes after fertilization retards the hardening process. Oxygen deficiency likewise inhibits membrane hardening. The possible mechanism of membrane hardening is discussed. It is suggested that membrane hardening is associated with a process of initiated chain polymerization of substances within the membranes. (Auth. abst.)

2564. Sparks, Albert K. 1958. SOME DIGENETIC TREMATODES OF FISHES OF GRAND ISLE, LOUISIANA. Proc. Louisiana Acad. Sci., Vol. 20, pp. 71-82; Biological Abstracts, Vol. 33, No. 4, Abst. No. 15621. 1959.

Forty-four species of trematodes are reported with host records; 6 spp. appear to be new but are not described. Eleven new host records are included, and 4 spp. are reported from the Gulf of Mexico for the first time: Homalometron pallidum, Pleorchis americanus, Diplomonorchis leiostomi, and Bathycotyle coryphaenae. (G. H. P.)

2565. Hancock, Charles D., Jr., and James E. Sublette. 1958. A SURVEY OF THE FISHES IN THE UPPER KISATCHIE DRAINAGE OF WEST CENTRAL

LOUISIANA, 1958. Proc. Louisiana Acad. Sci., Vol. 20, pp. 38-52; Biological Abstracts, Vol. 33, No. 4, Abst. No. 15994. 1959.

Forty-two spp. in 10 families represented by 5582 specimens are recorded. First records for Louisiana include: Erimyzon oblongus claviformis, Semotilus atromaculatus, Hybopsis amblops winchelli, Notropis atrocaudalis, N. umbratilis umbratilis, Lepomis marginatus, and Percina maculata. (G. H. P.)

2566. Honma, Yoshiharu. 1957. ON THE THYROID GLAND OF SOME JAPANESE TELEOSTS. (In Japanese with English summ.) Japanese Jour. Ichthyol., Vol. 6, No. 4/6, pp. 113-120; Biological Abstracts, Vol. 33, No. 4, Abst. No. 15996. 1959.

The author describes the thyroid gland of the following species: Scomber japonicus, Neothunnus albacora, Makaira mitsukurii, Oplegnathus septemfasciatus, Semicossyphus reticulatus and Aptocyclus Ventricosus. (M. G.)

2567. Kobayasi, Hiromu, and Isamu Yamabayashi. 1957. ON THE ACCELERATION OF SPAWNING IN A LOACH, MISGURNUS ANGUILLICAUDATUS (CANTOR), BY INJECTION OF THE HYPOPHYSES ON THE SAME SPECIES. (In Japanese with English summary). Japanese Jour. Ichthyol., Vol. 6, No. 4/6, pp. 170-176; Biological Abstracts, Vol. 33, No. 4, Abst. No. 16009. 1959.

The implantation of pieces of pituitary gland in female M. anguillicaudatus resulted in accelerated spawning. Some of the eggs were mature but most of them developed abnormally and died before hatching. (M. G.)

2568. Suyehiro, Yasuo, Shizuo Yoshino, Yoshikazu Tsukamoto. 1957. MOVEMENT OF THE FISH IN RESPONSE TO SOUND STIMULI WITH REFERENCE TO SOUND INTENSITY. Japanese Jour. Ichthyol., Vol. 6, No. 4/6, pp. 136-140; Biological Abstracts, Vol. 33, No. 4, Abst. No. 16030. 1959.

The behavior of 7 different species of teleosts in response to sound stimuli was observed, and was found to differ in different species. Scomber japonicus, Trachurus japonicus and Rhynchocymba nystromi nystromi were found to be rather sensitive to underwater noises, Conger japonicus and Astroconger myriaster much less so. (From auth. summ.)

2569. Tsukamoto, Yoshikazu, and Shizuo Yoshino. 1957. A STUDY OF THE LATERAL-LINE SYSTEM IN FISH. II. ON THE RELATION BETWEEN THE FUNCTION OF THE LATERAL-LINE ORGAN AND THE HABITS OF FISH. Japanese Jour. Ichthyol., Vol. 6, No. 4/6, pp. 131-135; Biological Abstracts, Vol. 33, No. 4, Abst. No. 16034. 1959.

In this continued study of the lateral line nerves of 81 species of teleosts, a correlation is found between the function of the lateral line and the habits of the species. It is suggested that the lateral line system may be particularly important whenever visibility is poor, as at night or in turbid water. (M. G.)

2570. Power, G. 1958. THE EVOLUTION OF THE FRESHWATER RACES OF THE ATLANTIC SALMON (SALMO SALAR L.) IN EASTERN NORTH AMERICA. Arctic, Vol. 11, No. 2, pp. 86-92; Biological Abstracts, Vol. 33, No. 5, Abst. No. 16210. 1959.

The life cycle of S. salar is typically divided between freshwater and marine environments. All Atlantic salmon do not conform to this pattern, however, and a number of forms, Quananiche, Sebago, landlocked, etc., complete their life cycles entirely in fresh water. These freshwater races are exceedingly widespread in eastern N. America. A gradual transition exists between forms found in the extreme northern parts of the area and those found in the southern part. The apparently different growth patterns are the result of the differences in length of growing season and in the amounts and type of food available. The numerous isolated populations of freshwater salmon, distributed over the entire range from north to south, form a cline and therefore ought not to be considered as 2 separate subspp., but rather to represent an assemblage of variable forms, which can be distinguished from the parent form by loss of the marine phase of the life cycle. This hypothesis regarding evolution of the freshwater salmon, is intended to serve until further data can be collected. Such data allows separation of the physiological factors concerned with migration from those concerned with reproduction and also an appraisal of the effects of severely cold climatic conditions on these two phenomena. (W. W. J.)

2571. Sara, M. 1957. PROBLEMS OF SPECIATION IN MARINE ANIMALS. (PROBLEMI DI SPECIAZONE NEGLI ANIMALI MARINE.) Attualita Zool., Vol. 9, No. 1/2, pp. 273-379; Biological Abstracts, Vol. 33, No. 5, Abst. No. 16212. 1959.

A review of microevolution in marine animals, with special consideration for the relations between environment and speciation. In only a few cases has the phenotypic or genotypic determination of morphological variability been ascertained experimentally. In the meristic characters of fishes a close correlation between environment and genetic factors has been established. The existence of geographic races, and consequently of spatial isolation mechanisms in speciation, is quite often observed in sea animals, both invertebrates and fishes. Proof of this type of raciation has not been given yet for some primitive organisms like the Porifera, Hydrozoa and Anthozoa. Because of the many little barriers present along the coast, the littoral organisms, and more especially the benthonic ones, shows a variability due to a microgeographical differentiation. This variability can sometimes be considered ecological, because of the great number of ecological niches present in this environment. It is still controversial whether this type of variation indicates a special microgeographic-ecological mechanism of speciation but environmental factors play a major role in the separation of the populations, although a spatial isolation may also be operating. A close correlation between environment and genetically determined

morphological and physiological variability is shown by some littoral marine animals. The existence and the adaptive significance of an introgressive hybridization in marine animals has also been discussed. Very little is known about the determination of physiological variability, which in only a few cases is indicated as due to genetical factors. Physiological adaptation, however, can be very important in the speciation process as indicated by the isolating mechanism in the teleostean fish, Gasterosteus aculeatus. A brief review of the aspects of reproductive and sexual variability, and the meaning of the ecological factors which can change the life cycle and biological equilibrium of the different faunae are discussed. The features of microevolutionary phenomena in special environments, like brackish waters and bathypelagic or abyssal conditions are also considered. (S. M.)

2572. Yanagimachi, Ryuzo. 1957. SOME PROPERTIES OF THE SPERM-ACTIVATING FACTOR IN THE MICROPYLE AREA OF THE HERRING EGG. Annot. Zool. Japon., Vol. 30, No. 3, pp. 114-119; Biological Abstracts, Vol. 33, No. 5, Abst. No. 16348. 1959.

The egg membrane of a limited area around the micropyle is highly endowed with a specific sperm-activating principle. The membrane piece excised therefrom exhibits a strong effect, even after being rinsed out for 30 minutes or longer with Ringer's solution, but it becomes readily ineffective when exposed to $CaCl_2$ and $MgCl_2$ solutions, or to Ringer's solution, or when it is either heated or modified by addition of acids or trypsin at concentrations so low that they do not affect the egg proper. (Y. W.)

2573. Kutkuhn, Joseph H. 1958. UTILIZATION OF GIZZARD SHAD BY GAME FISHES IN NORTH TWIN LAKE, IOWA. Proc. Iowa Acad. Sci., Vol. 65, pp. 571-579; Biological Abstracts, Vol. 33, No. 5, Abst. No. 16694. 1959.

In a study of a dredged prairie lake, food habit analyses of over 3000 yearling and adult game and pan fishes (7 species) collected during 1953-55 revealed forage fishes to be dominant prey. Chief predators were walleye, Stizostedion v. vitreum, and yellow bass, Roccus mississippiensis. Of primary interest were observable effects of violent fluctuations in prey populations. By virtue of a sustained mass irruption during 1954 and 1955, gizzard shad, Dorosoma cepedianum constituted primary forage during that period. This was in contrast to 1953 when a strong entering year class of yellow bass, in absence of a measurable shad population, was leading prey species. Comparatively smaller hatches of yellow bass in 1954 and 1955 did not appear to suffer as intense predation as did 1953 brood because of "buffering" capacity of sizeable, contemporaneous shad population. This does not preclude possibility that even though recently hatched game and pan fishes may have been exposed to reduced predation pressures, their survival may nevertheless have been adversely affected through direct competition with superabundant young shad for foods which both seem to require during early life stages. Because of comparatively slower growth, gizzard shad in North Twin Lake remain vulnerable to predation by greater proportions of predator populations even longer periods of time than evidence indicates they do in some other waters. (Auth. abst.)

2574. Halicki, Phillip J. 1958. A COMPARISON OF TWO METHODS OF DETERMINING TRANSPARENCY IN NATURAL WATERS. Trans. Amer. Micros. Soc., Vol. 77, No. 4, pp. 428-434; Biological Abstracts, Vol. 33, No. 5, Abst. No. 16736. 1959.

Two methods for measuring transparency in water, namely, Secchi disc and the submarine photometer (Weston photronic cell), were compared in waters near Bowling Green, Ohio, and in western Lake Erie. Factors relating Secchi disc readings to the depth to which 1% of surface light penetrated were computed. In western Lake Erie the man conversion factor was 4.3. These data show wide variations, including 1 extreme value of 7.5. The waters near Bowling Green yielded a conversion factor of 2.7 and the data were less variable. The conversion factor of 2.7 and the data were less variable. The conversion factor, therefore, varies considerably from place to place within a lake and between water bodies. No correlation was indicated between the ratio (of the depth) of the euphotic zone to Secchi disc and intensity of surface light. A study of the characteristics of suspended particles is suggested as an approach to a solution of the problem. (Auth. abst.)

2575. Hughes, G. M., and G. Shelton. 1958. THE MECHANISM OF GILL VENTILATION IN THREE FRESHWATER TELEOSTS. Jour. Exptl. Biol., Vol. 35, No. 4, pp. 807-823; Biological Abstracts, Vol. 33, No. 5, Abst. No. 17534. 1959.

The time course of pressure changes in the buccal and opercular cavities was recorded in the trout, roach and tench, and the movements of mouth and operculum plotted from films taken simultaneously. The prominent part of the buccal pressure curve is a positive pressure associated with mouth closing, whereas, in the opercular curve, a negative phase during abduction of the operculum is most marked. The flow of water is therefore maintained by the operation of a buccal force pump before the gills and an opercular pump after them. Except for a brief period the pressure in the buccal cavity exceeds that in the opercular cavities so that there will be an almost continuous flow of water over the gills from buccal to opercular cavities throughout the respiratory cycle. (Auth. abst.)

2576. Francois, Y. 1957. SEVERAL PROBLEMS ON THE DORSAL FIN OF TELEOSTS. (QUELQUES PROBLEMES RELATIFS A LA NEGEOIRE DORSALE DES TELEOSTEENS. Annee Biol., Vol. 33, No 9/10, pp. 413-426; Biological Abstracts, Vol. 33, No. 5, Abst. No. 20037. 1959.

Covers anatomy and development of the dorsal fin in Salmo, certain morphogenetic studies, and metamerism and concentration.

2577. Kobayashi, Kiyu. 1958. LARVAE AND YOUNG OF THE ATKA MACKEREL, PLEUROGRAMMUS MONOPTERYGIUS (PALLAS), IN THE NORTH PACIFIC. (In Japanese with English summ.) Bull. Fac. Fish. Hokkaido Univ., Vol. 8, No. 4, pp. 297-303; Biological Abstracts, Vol. 33, No. 5, Abst. No. 20041. 1959.

Young Atka mackerel are described and figured from 34 specimens 24-44 mm long, taken during the season from June 10 to July 2. (From auth. abst.)

2578. Kubo, Tatsuro. 1958. A NOTE ON THE AGE AND RACE OF THE RED SALMON IN THE NORTH PACIFIC OCEAN. (In Japanese with English summ.). Bull. Fac. Fish Hokkaido Univ., Vol. 8, No. 4, pp. 304-309; Biological Abstracts, Vol. 33, No. 5, Abst. No. 20042. 1959.

It is assumed that the populations of red salmon caught in the Aleutian area may not be of North American origin. This is based on the predominance of 63 age-class in the Aleutian area, with a small number in the southeastern Alaska-British Columbia area. It is also supported by data on the decrease of 63 age-class in the northwestern part of the Aleutian area during the 2d half of the fishing season with increase in the Okhotsk Sea. (From auth. summ.)

2579. Kusa, Mamoru. 1958. EXPLOSION OF ISOLATED CORTICAL ALVEOLI OF THE STICKLEBACK EGG. Annot. Zool. Japon., Vol. 31, No. 4, pp. 212-215; Biological Abstracts, Vol. 33, No. 6, Abst. No. 20344. 1959.

On exposure to extremely hypotonic media, the isolated cortical alveolus breaks down, thrusting out the contents through a breakage occurring at a site of the surface membrane, and a "ghost" like structure is left behind, which structure is seemingly the surface membrane of the alveolus. Both the contractility and the breakage formation in the surface membrane may be essential to the "explosion" of the isolated alveoli. (Y. W.)

2580. Dawson, C. E. 1958. A STUDY OF THE BIOLOGY AND LIFE HISTORY OF THE SPOT LEIOSTOMUS XANTHURUS LACEPEDE, WITH SPECIAL REFERENCE TO SOUTH CAROLINA. Contr. Bears Bluff Lab. 28: 1-48; Biological Abstracts, Vol. 33, No. 6, Abst. No. 20733. 1959.

The spot occurs from Mass. to Campeche in all depths to at least 112 fathoms. There are no confirmed records of its occurrence outside the continental limits of the United States and Mexico. The commercial fishery is centered in the Chesapeake Bay area and the Carolinas, and in recent years spot have ranked among the top 33% of United States fin-fisheries in both value and pounds. The bulk of the South Carolina catch, 3d among the producing states, is taken in beach seines during Sept. and Oct. Spot contribute over $100,000 annually to the economy of South Carolina. Spot are found from freshwater to salinities of over 60%, and were taken at temperatures of 6-36.7°C; lethal low temperature is near 5°C. Spawning occurs in moderately deep water and usually at some distance from the coast. Spawning season is protracted, probably from Oct. to March, with most fish spawning in Dec. and Jan. The majority of fish spawning along the South Carolina coast are nearing the end of their 2d year or early in their 3d year. Mature fish produce between 70 - 90,000 eggs. In contrast to findings in other areas, South Carolina supports a large winter population of spot, and these winter fish are generally larger than those reported in other studies on similar populations. Length-frequency data show that South Carolina spot probably attain a total length of 5.5-6.5 inches by the end of their 1st year and about 8-8.5 inches when they are 2 years old. Growth of wintering-over inshore fish is minimal until April or early May. The coefficient of condition (K) for individual South Carolina spot ranged from 1.39 to 2.96 and averaged 2.30. Seasonal variation in K is common to both young and maturing fish. Weight of South Carolina spot increased at a rate slightly less than the cube of the length. (Auth. abst.)

2581. Doi, Takeyuki. 1956. DYNAMICAL TREATMENT OF EXPLOITATION OF AQUATIC RESOURCE. II. EFFECT ON THE ASPECT OF APPEARANCE OF RECRUIT BY THE FEEDBACK OF INFORMATION OF THE SIZE OF STOCK. (In Japanese with English summ.) Bull. Tokai Reg. Fish. Res. Lab., 13. 73-84; Biological Abstracts, Vol. 33, No. 6, Abst. No. 20736. 1959.

The law of cause and effect between recruit and stock is expressed as the transfer function of 1st degree whose system has self-equilibrium. Generally the system, when feedback is introduced into it shows the dynamical characteristics of 2d degree, and then must have another parameter in addition to the mortality rate. According to the ratio of the 2 parameters, patterns of activity in population of various sizes are different. An analog computer is useful, to evaluate especially the property of fish population and fishing function. From the variations in day-by-day catch of larva and young of "katakuchi-iwashi" Engraulis japonica (HOUTTUYN) landed at Maisaka in 1955, instantaneous total mortality, natural mortality, dispersion and fishing mortality were calculated. But because of imperfect separation of these factors, we can not decide what form of feedback are controlling the behavior or organization of the fish. Results suggest that the variation is affected by the positive feedback. (From auth. abst.)

2582. Munoz Boyanes, Guillermo. 1958. LAKE SALMON FOR SPANISH MAINLAND WATERS. (SALMON DE LAGO PARA LAS AQUAS CONTINENTALES ESPANOLAS.) Montes, Vol. 14, No. 82, pp. 281-293; Biological Abstracts, Vol. 33, No. 6, Abst. No. 20750. 1959.

The characteristics and life history of lake

salmon or "kokanee" (Oncorhynchus (Hypsifario) nerka kennerlyi) are described. Studies of fingerlings hatched from eggs brought by air from Washington State (USA) indicate that this fish is less suitable for stocking Spanish lakes and reservoirs than the native trout and salmon. (W.N.S.)

2583. Yoshimuta, Chosei, and Shinsuke Mitsugi. 1956. EFFECT OF SUPERSONIC WAVE ON BEHAVIOR OF FISH. (In Japanese with English summ.) Bull. Tokai. Reg. Fish Res. Lab. 13. 51-60; Biological Abstracts, Vol. 33, No. 6, Abst. No. 20756. 1959.

Super-sonic waves of a 50KC fish-finder were discharged continuously for periods from 10 to 150 hours on various spp. of fish kept in a tank. The fish used for the test were young or adult of goldfish, dace, rainbow trout and killifish. No effect of the super-sonic waves was obvious on these fishes during the discharge and rearing periods following the test. Continuous or intermittent discharge of the super-sonic waves did not affect behavior of such pelagic fish as the sardine, horse-mackerel and mackerel which were kept under several different conditions. However, a series of remarkable effects were observed on physiological condition of the specimens of killifish, goldfish and carp when they were subjected for 5-30 minutes to continuous discharge of super-sonic waves of 24 KC for industrial use, which was about 10 times more powerful than the super-sonic fish finder. These were: (a) the red blood corpuscles were destroyed or deformed; (b) the scales fell off; the body lost balance; agitated movement; internal hemorrhage on the gill cover were symptomatic; (c) the liver, pancreas and spleen were contracted or discolored; (d) the mortality rate of the tested group was 1. 2-3 times as much as the controls during the rearing period after the discharge; (e) shapes of fins, tails and colors of skin were changed. (Auth. abst.)

2584. Wood, J. D. 1958. NITROGEN EXCRETION IN SOME MARINE TELEOSTS. Canadian Jour. Biochem. and Physiol., Vol. 36, No. 12, pp. 1237-1242; Biological Abstracts, Vol. 33, No. 6, Abst. No. 21108. 1959.

The nitrogen-containing compounds excreted by the sculpin, starry flounder and blue sea-perch were investigated. Approximately four-fifths of the nitrogenous material was excreted via the gills. Ammonia and urea were the main components of the excreta in all three species. The amount excreted in 24 hours varied greatly between fish of any one species, but the percentage composition was reasonably constant. A greater variation in the composition occurred between species. Trimethylamine oxide was present in only small amounts in the total excreta. It was concluded from this that the compound was not an important end product of protein metabolism. (Auth. abst.)

2585. Fortune, P. Y. 1958. THE EFFECT OF TEMPERATURE CHANGES ON THE THYROID-PITUITARY RELATIONSHIP IN TELEOSTS. Jour. Exptl. Biol., Vol. 35, No. 4, pp. 824-831; Biological Abstracts, Vol. 33, No. 6, Abst. No. 21863. 1959.

The thyroid-pituitary relationship in Phoxinus laevis is affected by changing environmental temperature. The secretion of thyrotrophic hormone, estimated by histological examination of the pituitary, is increased at high temperatures. The thyrotrophic hormone has a more marked effect on the thyroid at high temperatures; consequently thyroid activity is increased at high temperatures. The change in thyroid activity is independent of the temperature to which the fish have previously been exposed. It is suggested that changes in the thyroid and pituitary indicate attempted adaptation to environmental conditions whereas a constant state indicates successful adaptation regardless of the actual amount of hormones produced. In contrast, the thyroid--pituitary relationship in Carassius auratus is not affected by temperature changes. (Auth. abst.)

2586. Prescott, David M. 1955. EFFECT OF ACTIVATION ON THE WATER PERMEABILITY OF SALMON EGGS. J. Cell. and Comp. Physiol., Vol. 45, No. 1, pp. 1-12; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24275. 1959.

The cartesian diver balance-heavy water method was used to measure water permeability of unactivated and activated (water hardened) salmon (Oncorhynchus tshawytscha) eggs in the process of activation. Unactivated eggs are slightly water permeable but become completely impermeable within 25 minutes after activation has begun. The chorion is freely permeable to water, and the impermeability of activated eggs resides in the plasma (yolk) membrane. The change of the impermeable state may be due to the precipitation of lipoproteins at the yolk surface.

2587. Kubota, Zenziro, Isao Matsui, and Genzi Shirahane. 1957. STUDIES ON THE REPRODUCTION OF THE LOACH, MISGURNUS ANGUILLICAUDATUS (CANTOR). II. ON THE INFLUENCE OF THE LOACH POPULATION DENSITY UPON THE PRODUCTIVITY OF POND. Jour. Shimonoseki Coll. Fish., Vol. 7, No. 1, pp. 129-139; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24386. 1959.

Experiments of the loach on the relations of population density to weight-multiplication rate (W), decreasing rate (N) and food quotient (F). The results are as follows: (1) The larger the population density, the smaller the weight-multiplication rate and individual body weight. While the decreasing rate and food coefficient become higher. (2) The relation between population density (X) per 3.31 sq. m (tsubo) and weight-multiplication rate (W) is: $W=33.817X^{-1.0042}$ (3) The relation between population density (X) and body weight (Y) at the close of the experiments is: $Y=43.763X^{-0.5879}$ (4) The relation between population density (X) and average weight of one loach (Y') is: $Y=1.790X^{-0.4707}$ (5) The relation between population density (X) and food quotient (F) is: $F=0.058X-2.354$ (6) The relation be-

tween population density (X) and decreasing rate (N) is: N=0.063X-2.209. (Auth summ.)

2588. Chuman, Michio. 1955. FUNDAMENTAL STUDIES ON THE RELATION OF UNDERWATER SOUND TO THE FISH BEHAVIOUR. (I) ABOUT THE SOUNDS BY DROPPING OR SHOWERING. (In Japanese with English summ.) Mem. Fac. Fish. Kagoshima Univ. 4:61-64; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24538. 1959.

To study the effect on bonito fishing of underwater sound from rainfall, the author set up various sounds by dropping water or showering the surface, with the following results: As expected, the sound pressure was proportional to the intensity of drop or shower. When the water surface was bubbled violently, sound pressure in air was very strong, but the sound pressure underwater was not so strong. Also described are certain means whereby "biological" sounds may be picked up instrumentally.

2589. Miyamoto, Hideaki. 1957. BEHAVIOURS OF FISHES ENTERING TRAP NETS. Bull. Tokai Reg. Fish. Res. Lab. 15. 77-87; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24548. 1959.

Using a 2-mouth-2-bag-type of trap net the behaviors of some kinds of fishes was studied in regard to the selectivity of the bag position and the trapping efficiency affected by current directions and velocities when the bags were entered. Pelagic fishes like bluefin tuna, dolphin and mackerel showed a remarkable behavior, common among them, to choose the right bag, although no such common behavior was found among neritic fishes such as yellowtail, porgy, plaice and some other species. Yellowtail, one of the most important spp. for trap net operations, had no selectivity of position between the right and left bags, but showed a peculiar tendency to enter through a very narrow opening to the bag specially constructed to trap them. The northern current was effective in increasing catch in the right bag, but ineffective for the left, while the southward current brought considerable catches of tunas to both bags. In case of plaice the left bag had a somewhat better catch than the right. On the whole, the bag installed at the further end of a trap in the northerly current caught more fish than the bag at the opposite end for almost all fishes observed in the experiments. The faster the current the poorer was the catch. The catches, except for plaice, declined sharply in current velocities over 0.3 knot. The upper limit of current velocity for the operation of trap nets has been estimated at 0.5-0.6 knot. (Auth. summ.)

2590. Muller, Karl. 1957. CONTRIBUTIONS TO THE BIOLOGY OF JUVENILE SALMON IN THE STORA AND LILLA LULE ALV. (ZUR BIOLOGIE DES JUNGLACHSES (SALMO SALAR L.) IM STORA AND LILLA LULE ALV.) Ber. Limnol. Flusssta. Freudenthal, 8: 33-59; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24579. 1959.

Lule Alv is 1 of 3 northern Swedish rivers best for breeding salmon and it is 1 of the best of all European rivers. Breeding time and methods of capture of salmon in river and in Gulf are described. Lule Alv has 2 main branches (Stora Lule Alv and Lilla Lule Alv) in which salmon breeding occurs. Lilla Lule Alv has been disturbed little by man (although plans have been made for its utilization for water power), but there are several hydroelectric plants on Stora Lule Alv. Existence of young salmon is greatly hampered in Stora Lule Alv, primarily by rapid daily fluctuations of water level, and secondarily by relative sparsity of suitable food, and by temperature conditions imposed by hydroelectric plants. Growth of fish in 2 branches of river did not differ much. It is thought that sparsity of food in rivers results in reduction of numbers rather than in reduction of growth rate. Stomach analyses are reported. Main food of young fish was bottom fauna, but imagoes of terrestrial insects, and of insects whose larvae are aquatic, were also important. (C. C. D.)

2591. Steffan, August Wilhelm. 1957. COMPARATIVE ECOLOGICAL INVESTIGATIONS OF GROWTH AND FEEDING OF TWO POPULATIONS OF S. TRUTTA OF THE NORTH SWEDISH WOODED REGION. (VERGLEICHENDE-OKOLOGISCHE UNTERSUCHUNGEN UBER WACHSTUM UND ERNAHRUNG VON ZWEI SALMO TRUTTA-POPULATIONEN DES NORDSCHWEDISCHEN WALDGEBIETES.) Ber. Limnol. Flussta. Freudenthal 8:60-93; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24582. 1959.

Two populations of trout, Salmo trutta, were studied. One was from an unusual habitat for trout, namely a boggy pond, Rappojaure. Second population was from a typical habitat, a brook, Messaurejokk. Both waters flow into river Stora Lule Alv in Swedish Lappland. Physical and chemical conditions of water were similar in habitats, but biotic conditions differed greatly. Growth of young trout was greater in pond, whereas growth of older forms was greater in stream. Stomach analyses suggest that basis of this growth difference lies in available food. Main food of older trout in stream was larvae of Ephemeroptera, and these insects were entirely lacking in pond. Differences of feeding habits of different age groups are detailed for habitats. Possibilities for commercial use of ponds similar to Rappojaure are discussed. (C. C. D.)

2592. Bernard, F. 1958. LA PROBLEME BIOLOGIQUE DE LA FERTILITE MARINE ELEMENTAIRE. Bull. Soc. Hist. Nat. Afrique du Nord, Vol. 49, No. 1/2, pp. 44-73; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24606. 1959.

A summary of the author's investigations in the Mediterranean and of an International Symposium in 1957 at Bergen on fertility of marine unicellular plankton. While diatoms in cold oceans and flagellates in warm oceans predominate near the surface, flagellates are most abundant at 300 to 400m in the Mediterranean. Controlled experiments on photosynthetic activity show the greatest activity near the surface in any water. The controlling factor in the Mediterranean seems to be extremely low phosphorus

content near the surface, where continental drainage furnishes very little dissolved phosphate. At moderate depth, Atlantic water enters the Gibraltar strait and forms a phosphorus-rich layer at the level where flagellates are most abundant. Correlated with the microplankton abundance at that level is the experience of sardine fishermen in harvesting their catch in this region in the Mediterranean. (H. B. B.)

2593. Kuroki, Toshiro. 1954. ON THE RELATION BETWEEN WATER TEMPERATURE AND THE RESPONSE FOR STIMULI. THE INVESTIGATION TO DECIDE THE "OPTIMUM TEMPERATURE." (In Japanese with English summ.) Mem. Fac. Fish. Kagoshima Univ., Vol. 3, No. 2, pp. 19-24; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24623. 1959.

The thresholds of fishes electrified by various rectangular impulses were investigated under the water temperature 5°, 10°, 15°, . . . , 35°C. As the results of this test, it was cleared that the temperature (T_1) under which the rheobase indicated minimum value was about 13. C and that the one (T_2) under which the chronaxie indicated minimum value was about 25°C. Through the investigation of the applicable range of Tamiya's theory, the author tried to redefine "optimum water temperature" at both the oceanographic and biological conditions; and concluded as follows:--Fishes are the "being" wandering to seek T_1 or T_2 then the optimum temperature must be changed according to "ground" and "season". The prediction of fishing ground and season will be developed by using the results elicited from the investigation of these oceanographic and biological conditions. (Auth. summ.)

2594. Smith, F. G. Walton. 1958. MYSTERY OF THE RED TIDE. Smithsonian Rept. 1957 (4326): 371-380; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24636. 1959.

The history of plagues due to various plankton blooms is traced, with special reference to the red tide as it occurred on the west coast of Florida. The organism responsible for the wholesale death of fish and other marine life, for the unpleasant odors, gases irritating to the human respiratory tract, and economic loss to the tourist business was identified as a new species, named Gymnodinium brevis. Research on the causes for the occasional appearance of this organism in great quantity resulted in an extensive analysis of tides and currents. The red tide floats on the less dense brackish bay water, but the difference in density must not be too great or the organisms will be too widely dispersed. A formula for predicting red tide outbreak was devised using weather information, but its accuracy will have to be determined by time. (F. M. F.)

2595. Bogan, R. H. 1958. BIOCHEMICAL DEGRADATION PRODUCTS. A NEW DIMENSION IN STREAM POLLUTION. Sewage and Indust. Wastes, Vol. 30, No. 2, pp. 208-214; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24645. 1959.

Using results of research on biochemical decomposition of alkyl benzene sulfonates as examples, the author indicates that intermediate biochemical degradation products of varying oxidizability result from decomposition of complex organic substances. Expressions of total oxygen demand such as BOD or COD are not felt to be sufficiently descriptive of the biochemical state of such systems. The importance of enzymatic hydrolysis as a rate-controlling reaction in such systems is underlined. (I. G.)

2596. Buscemi, Philip A. 1958. LITTORAL OXYGEN DEPLETION PRODUCED BY A COVER OF ELODEA CANADENSIS. Oikos, Vol. 9, No. 2, pp. 239-245; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24647. 1959.

Data obtained from Parvin Lake (altitude 2499 m) in Larimer County, Colorado, showed a greatly decreased O_2 content in the lower layers of water under a dense growth of Elodea canadensis. Oxygen was high at all depths in deeper water beyond the Elodea patch. A vertical series of samples showed about 8 ppm O_2 in the water above the plants, followed by an increase to about 9 ppm in the upper layers of the submerged plants, and by a rather rapid decrease in the lower layers of the plants to 0.4 ppm 5 cm above the bottom. It is thought that the decrease of turbulence in the lower portions of the Elodea community, coupled with a decrease or prevention of photosynthesis by shading, contributed to the low O_2 values. (C. C. D.)

2597. Hirsch, Allan. 1958. BIOLOGICAL EVALUATION OF ORGANIC POLLUTION OF NEW ZEALAND STREAMS. New Zealand Jour. Sci., Vol. 1, No. 4, pp. 500-553; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24653. 1959.

The bottom faunas of polluted New Zealand streams were studied with the object of devising biological criteria for evaluating the extent and severity of organic pollution. The pollution tolerance of various organisms was determined, but this could not be done for all the species encountered. The assemblages of fauna found in stony-bottomed streams show characteristic reactions to pollution. In grossly polluted areas the fauna is comprised largely of tubificid worms and sometimes includes naid worms and certain chironomid larvae. In somewhat less polluted areas, a mulluscan fauna is commonly present as well. With still decreasing degrees of pollution, caddis flies and a number of other organisms are able to survive, until finally even the sensitive mayfly group is unaffected. Sand and silt-bottomed streams afford little suitable substrate for the development of some of these organisms and there the effects of pollution are not so clearly reflected. Seasonal variations affect the evaluation of pollution as well as does this environmental limitation. Evaluation can be conducted long after the critical period has passed, but the results are often less clear-cut and more subject to judgment in interpretation than those collected during or shortly after the critical period. (Auth. summ.)

2598. Desmarais, Yves. 1958. COMPARISON OF GROWTH AND FEEDING OF SPECKLED TROUT FROM LAURENTIDES PARK AND RIMOUSKI. (CROISSANCE ET ALIMENTATION COMPAREE DE LA TRUITE DU PARC DES LAURENTIDES ET DE RIMOUSKI.) Naturaliste Canadien, Vol. 85, No. 4, pp. 73-78; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24679. 1959.

In the summer of 1956, 300 Salvelinus fontinalis from Lake Pikauba (Laurentides Park) were measured, tagged, and transferred to Lake Ouimet (Rimouski County); 157 from Ouimet were transferred to Lake Mathias (Laurentides); and 200 from Mathias were transferred to Pikauba. Also, 275 Ouimet trout and 200 Mathias trout were measured, tagged, and left in their original lake. The following summer 105 tagged fish were recaptured and measured. This sp. grows better in a slightly acid environment such as Mathias. Since only the Lake Ouimet fish regularly feed on small fish, the stomach contents of all fishes were examined. The habit persisted in Ouimet fishes transferred to Mathias. This latter group showed the greatest growth. They utilized the environmental resources maximally. (G.R.B.)

2599. Mayhew, James. 1956. THE BLUEGILL, LEPOMIS MACROCHIRUS (RAFINESQUE) IN WEST OKOBOJI LAKE, IOWA. Proceedings of the Iowa Acad. Sci., 63: 705-713; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24688. 1959.

Angler harvest of bluegills in West Okoboji was highest in 1953 and lowest in 1946. The catch during the past 7 years was relatively stable. Mean calculated lengths from the 1 to the 7 annuli were 31, 69, 108, 134, 150, 166, and 183 mm. Annual growth increments were 31, 38, 42, 24, 16, 12, and 8 mm for the 1 through the 7 year respectively. Body-scale relationship for 228 bluegills is best described by the least squares equation L = 12.9 mm + 1.168R. The length-weight relationship is expressed as Log W = -4.16809 + 2.93521 Log L. The "K" factor was 5.04 for 228 bluegills. Annual survey records from 1940 to 1954 indicate a fairly stable population of bluegills in West Okoboji. In 1954, nest building probably started by June 15, but the 1st spent female was found on June 25. The peak of spawning was probably over by July 5. Egg counts ranged from 7200 eggs for a 142 g female to 38,184 eggs from a 234 g fish. (Auth. summ.)

2600. Paloumpis, Andreas A. 1958. MEASUREMENT OF SOME FACTORS AFFECTING THE CATCH IN A MINNOW SEINE. Proc. Iowa Acad. Sci., 65: 580-586; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24698. 1959.

Periodic seining with a 20 foot minnow seine gave satisfactory estimates of changes in the fish populations of an intermittent stream. Downstream hauls captured more spp. and individuals than upstream hauls. Greater catches were made after dark, and at lower water levels. Study of variances indicate that about 45 seine hauls are needed to detect a 50% change in population numbers. (K.D.C.)

2601. Vladykov, Vadim D., and G. Beaulieu. 1958. VARIATIONS IN THE ANNUAL ABUNDANCE, IN QUEBEC, OF FISHES NATIVE TO THE GREAT LAKES. (VARIATIONS DANS LE QUEBEC DE L'ABONDANCE ANNUELLE DES POISSONS ORIGINAIRES DES GRANDS-LACS. Naturaliste Canadien, Vol. 85, No. 6/7; pp. 149-156; Biological Abstracts, Vol. 33, No. 7, Abst. No. 24713. 1959.

Dorosoma cepedianum, Lepibema chrysops, and Morone americana have recently been introduced and seem to be definitely established in the St. Lawrence River. D. cepedianum and L. chrysops were first caught in 1944; M. americana entered Lake Ontario from the Oswego River (New York). It first appeared in 1952. A table containing the number of specimens sent to the authors' laboratory in the period 1944-1957 is included. The authors conclude that the St. Lawrence Seaway will bring more active faunistic changes between the lakes and the river. (G.R.B.)

2602. Matsui, Isao. 1957. THE NUMBER OF EGGS DISCHARGED AT ITS PRIMARY SPAWNING IN RELATION TO THE NUMBER OF OVARIAN EGGS IN CARP. (In Japanese with English summ.) Jour. Shimonoseki Coll. Fish, Vol. 7, No. 1, pp. 147-150; Biological Abstracts, Vol. 33, No. 7, Abst. No. 25530. 1959.

The number of eggs found in the ovary of carp, namely, 190,000-700,000, is reduced to 15.4-51.9% by discharging 50,000-620,000 eggs at the primary spawning. The number of eggs of the primary discharge (P) stands in relation to the body weight (W) as given by the formula (1).

$$P = \frac{651,800}{1 + e^{3.500 - 0.953W}} \cdots\cdots (1)$$

The formula (2) describes the relation between the number of ovarian eggs (O) and body weight.

$$O = 735,300 \left\{1 - 0.732^{-o.374(W-1)}\right\} \ldots (2).$$

These formulae suggest that a female over 4 kg in weight should be employed for successful artificial insemination. (Auth. summ.)

2603. Ishiyama, Reizo, and Keisuke Okada. 1957. POSTLARVAL FORM OF THE SKIPJACK (KATSUWONUS PELAMIS) FROM THE PHOENIX ISLANDS. (In Japanese with English summ.) Jour. Shimonoseki Coll. Fish., Vol. 7, No. 1, pp. 141-146; Biological Abstracts, Vol. 33, No. 7, Abst. No. 28074. 1959.

Several young fishes were caught near the Phoenix Islands, central Pacific. The characteristic features of the young, measuring from 5 mm to 8 mm, agree well with those of the postlarvae of the skipjack, which were described by Wade (1953) and others. (Auth. summ.)

2604. Neave, Ferris. 1958. THE ORIGIN AND SPECIATION OF ONCORHYNCHUS. Trans. Roy. Soc. Canada, Sect. 5, Ser. 3, 52-25-39; Biological Abstracts, Vol. 33, No. 7, Abst. No. 28086. 1959.

The genus Oncorhynchus (Pacific salmon) was

derived recently from Salmo. The initial divergence is considered to have taken place within the last 400,000-800,000 years, most probably in the region of the present Sea of Japan. Differentiation of the 6 existing anadromous spp. of the genus was probably initiated by the development of distinctive breeding color patterns during periods of geographic isolation of populations. (Auth. abst.)

2605. Hagelin, L-O. 1958. NOTES ON THE SPAWNING HABITS OF THE RIVER LAMPREY (PETROMYZON FLUVIATILIS). Oikos, Vol. 9, No. 2, pp. 221-238; Biological Abstracts, Vol. 33, No. 8, Abst. No. 28563. 1959.

Nest building, courtship, and the spawning act were observed in running-water aquaria in the laboratory. The male constructs a nest by moving small stones and exposing the sandy substratum. Nests were built preferably on sandy substrata, and in the shade. Response to the substratum took precedence over the response to shade, for if substrata were not shaded, nest building took place in sunlight. After nest construction by the male, the female would establish herself in the nest; thereupon the male courted her, and this was followed by spawning. These events are described in detail. About one week after spawning all animals died. The authors believe this occurs also in nature. (C. C. D.)

2606. Okubo, Katsuwo. 1957. STUDY ON THE BIO-ASSAY METHOD FOR THE EVALUATION OF WATER POLLUTION--I. AN ATTEMPT TO USE BRINE SHRIMP AS A TEST ANIMAL. (In Japanese with English summary.) Bull. Tokai Reg. Fish Res. Lab., 18, pp. 31-36; Biological Abstracts, Vol. 33, No. 8, Abst. No. 28640. 1959.

It was proved in the series of experiments that the same response values were repeatedly obtained for the definite concentrations of sodium cyanide and mercuric chloride. It was recommended for the bio-assay method to employ the 48 hours (after the start of incubation) stage larvae and to get the TLm in 24 hours at temperatures below 20°C. Although responses of Artemia larvae were slightly insensible compared with those of other marine animals for effects of some pollutants, we should not make a serious mistake if we take the one-hundredth of Artemia's response values as the measure of the safety concentrations of some pollutants for general marine organisms. If we find out the more reliable correlation factors between the tolerance limit of Artemia and that of the other marine organisms on the several typical pollutants, we would have a convenient means in the investigation of water pollution in the sea. (Auth. summ.)

2607. Ambuhl, H. 1958. THE PRACTICAL UTILIZATION OF ELECTROCHEMICAL OXYGEN DETERMINATION IN WATER. (DIE PRAKTISCHE ANWENDUNG DER ELEKTROCHEMISCHEN SAUERSTOFFBESTIMMUNG IM WASSER.) Schweiz. Zeitschr. Hydrol., Vol. 20, No. 2, pp. 341-359; Biological Abstracts, Vol. 33, No. 8, Abst. No. 28645. 1959.

The effects upon electrochemical test results for O_2 of such external influences as conductivity of the water, temperature, current, and cathode surface are described. Three oxygen sounders are described and pictured. The simplest of these tests only for O_2. The 2d tests for O_2 and temperature, and the 3d tests for O_2, temperature and conductivity all in the same instrument, and at the same position in the water. The disturbing influence of temperature on the measurement of O_2 is compensated electrically. Examples of measurements in some Swiss Midland lakes are given. These show details of O_2, temperature and conductivity stratification undetected by other means. (C. C. D.)

2608. Chigusa, Masanori, Masuo Takase, and Makoto Hirose. 1955. DETECTION OF THE WITHERED TREE BELOW THE SURFACE BY THE ULTRASONIC ECHO SOUNDER. (In Japanese with English summ.) Jour. Shimonoseki Coll. Fish., Vol. 4, No. 3, pp. 275-278; Biological Abstracts, Vol. 33, No. 8, Abst. No. 28654. 1959.

In an attempt to distinguish between the records of fish schools, and those of drowned and decayed trees, by an ultrasonic echo-sounder, an experiment was undertaken at Lake Ono, an artificial lake constructed by the Koto Power-plant, Ube city, in November and December 1954. With a 50 KC ultrasonic fish-finder, it is possible to distinguish fish schools from drowned trees (pine-, persimmon-, mulberry-, shrubs and bushes). (Auth. abst.)

2609. Weinreb, Eva Lurie. 1958. STUDIES ON THE HISTOLOGY AND HISTOPATHOLOGY OF THE RAINBOW TROUT, SALMO GAIRDNERI IRIDEUS. I. HEMATOLOGY: UNDER NORMAL AND EXPERIMENTAL CONDITIONS OF INFLAMMATION. Zoologica (New York), Vol. 43, No. 4, pp. 145-154; Biological Abstracts, Vol. 33, No. 8, Abst. No. 29150. 1959.

In normal blood, using phase contrast microscopy, the predominant leucocyte is the lymphocyte, the heterophil is scarce, and eosinophils and basophils seen only occasionally. Turpentine produced a sterile inflammation, resulting in heterophilia, lymphopenia, and thrombocytopenia. Blood counts, made over a 72-hour period, revealed marked heterophilia at 6 hours due to release of myelocytes and metamyelocytes. Cortisone, given concurrently and in advance of turpentine, reduced the inflammatory response, while advance injection also reduced mortality by almost 50%. Decrease in lymphocyte number appears to be in direct response to adrenal cortical stimulation initiated by ACTH. Heterophilia is not under direct adrenal cortical control, but subject to a wider range of influencing factors. The mechanisms of leucocyte control, as well as physiological response of each cell type, in the trout is comparable to that in mammals. (Auth. abst.)

2610. Weisel, George Ferdinand. 1955. THE OSTEOLOGY OF MYLOCHEILUS CAURINUM X PTYCHOCHEILUS OREGONESE, A CYPRINID HYBRID, COMPARED WITH ITS PARENTAL

SPECIES. J. Morph., Vol. 96, No. 2, pp. 333-358; Biological Abstracts, Vol. 33, No. 8, Abst. No. 29639. 1959.

The basic osteology of Mylocheilus caurinum and Ptychocheilus oregonese is similar to other cyprinids. It reveals that the two species are closely related and that Mylochailus is probably the more primitive. The bones of the skull and the pharyngeal teeth of Ptychocheilus exhibit an adaptation to more predatory feeding habits than Mylocheilus. There are other specific characters, such as the number of sensory pores, which are not directly related to this particular adaptation. The bony structure of specimens presumed to have resulted from the hybridization of Mylocheilus with Ptychocheilus are intermediate in practically every character in which the putative parents differ. No characters were found in the hybrid that are unique. This lends strong support to the original identification of the specimens as M. caurinum x P. oregonese which are based primarily on intermediacy of external meristic characters.

2611. Rasquin, Priscilla. 1955. OBSERVATIONS ON THE METAMORPHOSIS OF THE BONEFISH, ALBULA VULPES (Linnaeus). J. Morph., Vol. 97, No. 1, pp. 77-118; Biological Abstracts, Vol. 33, No. 8, Abst. No. 29877. 1959.

Macroscopical, histological and histochemical studies were made on larval Albula vulpes during the process of metamorphosis. The transparent larva is transformed into a miniature adult opaque bonefish approximately one-half its original length in a period of 8 to 12 days depending on the temperature. Four larvae in various phases of the transformation process were serially sectioned and studies were made of the conditions of various organ systems at those times, including skeletal and supporting systems, vascular and visceral tissues, sense organs and endocrine organs. The most interesting feature of the larva was a large core of acellular, gelatinous, fibrous material surrounding the notochord and median blood vessels, separating the axial organs from developing musculature and viscera and occupying over half the volume of the animal. The gelatinous core gradually disappeared as the larva shortened in length and was apparently utilized as a nourishing factor in the metabolism of the organism inasmuch as the metamorphosing larvae did not feed until the material was resorbed. The possibility of such utilization is borne out by the results of histochemical tests which showed the gelatinous material to be composed of neutral fats and acid mucopolysaccharides, Positive alkaline phosphatase reactions about blood vessels traversing the core indicated that transport of materials was probably occurring from the gelatinous core into the blood vessel for distribution throughout the body.

2612. Hubbs, Carl L., and Karl F. Lagler. 1958. FISHES OF THE GREAT LAKES REGION. Cranbrook Inst. Sci. Bull., 26. 1-213; Biological Abstracts, Vol. 33, No. 8, Abst. No. 31921. 1959.

This present revision, although the first reissue of Bulletin 26, is actually the 3d major change of work in the present series. The 1947 printing of this work under the title "Fishes of the Great Lakes region", was an enlargement of the Guide to the fishes of the Great Lakes and tributary water" (Bull. 18), appearing in 1941. In the years since the first appearance of this guide, much new information has come into being on the distribution of fishes that inhabit the Great Lakes drainage basin. In the interval there has also been a tendency to change the names of fishes, many in use for a long time. It has been the work of the authors of this present volume to evaluate proposals for such changes and to adopt those that seem warranted. The book has 38 colored plates.

2613. Szubinska-Kilarska, B. 1958. THE ADIPOSE FIN IN SALMONIDAE. Bull. Acad. Polonaise Sci. Ser. Sci. Biol., Vol. 6, No. 8, pp. 347-351; Biological Abstracts, Vol. 33, No. 8, Abst. No. 31936. 1959.

The adipose fin was examined in 4 spp. of Salmo, 2 spp. of Coregonus, 5 spp. of Oncorhynchus and 1 spp. of Thymallus. The adipose fin is in all fish examined a boneless structure, a skin fold covered with stratified squamous epithelium. Not in every specimen examined the fin contained fat. It appears that the presence of fat depends upon sps., age and condition of the fish. (H. S.)

2614. Huzita, Tikao. 1955. AN EXPERIMENT ON THE TRIAL MANUFACTURE OF LEAD PLATE DEPTH-FINDER FOR FISHING TOOLS. (In Japanese with English summary.) Mem. Fac. Fish. Kagoshima Univ., 4. 42-46; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32092. 1959.

To measure the depth of the fishing nets or tools in the sea, an apparatus with Pb plate was devised. The relations between the deformation of the plate and the holder of the plate under the various pressures were closely examined using the apparatus. The experiments showed plate thickness 0.50, 0.75, 1.00 $^{m}/m$ is suitable to measure the depth of the nets or tools, when they are used in the depth of less than about 60, 80, 100 m. (Auth. summ.)

2615. Yoshihara, Tomokichi. 1957. ON THE TYPE OF FREQUENCY CURVE OF THE CATCH--II. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish, Vol. 22, No. 10, pp. 618-620; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32298.

The previous paper showed that the frequency curve of the catch may be represented approximately by the normal logarithmic curve. This paper shows that when the catch is distributed by the exponential distribution, the logarithm of the catch may be represented by a frequency curve which is very close to the normal logarithmic distribution curve. (Auth. abst.)

2616. Goss, Richard Johnson. 1955. THE EF-

FECT OF X-RAYS ON TASTE BARBEL REGENERATION IN THE CATFISH, AMEIURUS. Am. J. Anat., Vol. 97, No. 1, pp. 59-78; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32474. 1959.

Normal regeneration of catfish taste barbels can be retarded by exposure to X-ray doses of 1000 r and 2000 r and prevented in all cases by 3000-5000 r. Since regeneration of cartilage, either following barbel amputation or transection of the cartilaginous rod, is inhibited by doses which do not prevent the regeneration of short, rodless epidermal growths, it is concluded that the epidermis is less sensitive to X-rays than is the generative perichondrium surrounding the cartilaginous rod. The irradiation injury to the latter considered to be largely responsible for failure of regeneration of the X-rayed barbels. Unirradiated barbels containing cartilaginous rods exposed to a normally inhibiting dose of 4000 r regenerate less than controls but more than do irradiated barbels containing untreated cartilaginous rods. It is the injury to the epidermis, which plays a more essential role in barbel regeneration than cartilage, to which these results are attributed.

2617. Desmarais, Yves. 1959. FECUNDITY AND GROWTH OF THE TROUT (SALVELINUS FONTINALIS) IN THREE LAKES OF THE LAURENTIDES PARK. (FECONDITE ET CROISSANCE DE LA TRUITE (SALVELINUS FONTINALIS) DANS TROIS LACS DU PARC DES LAURENTIDES. Naturaliste Canadien, Vol. 86, No. 2, pp. 33-45; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32564. 1959.

Fecundity and growth of 3 comparable populations of tagged brook trout in lakes Choumine, Pelletier, and Jupiter were measured. The Choumine trout grew less rapidly than those of the other lakes; the females contained fewer eggs, because of great individual variation the difference was not significant. A correlation might exist between the fecundity expressed as the number of eggs undergoing maturation and trout growth, but sampling difficulties and other factors weaken the certitude of this interpretation. In all populations, total number of eggs increased during the summer. The number of late-maturing eggs diminished slightly because of atresia. (G.R.B.)

2618. Musiał, L., L. Turoboyski, M. Chobot, and W. Łabuz. 1958. INVESTIGATIONS ON CONTAMINATION OF THE SOŁA RIVER AND ITS SELF PURIFICATION CAPABILITIES. (BADANIA NAD ZANIECZYSZCZENIEM RZEKI SOŁY I JEJ ZDOLNOSCIA SAMOOCZYSZCZANIA.) (In Polish with Russian and English summ.) Polskie Arch. Hydrobiol., 4: 221-250; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32568. 1959.

Investigations on the Sola River, which included field and laboratory observations, physico-chemical, hydrobiological and bacteriological tests, were carried out in an annual cycle, and were aimed at classifying this river, determining its degree of contamination, and self purification capabilities. The authors based their work on: physiographic and hydrological data; on results of field and laboratory observations, physicochemical, hydrobiological and bacteriological tests presented descriptively in the form of graphs and tables. The influence on micro- and macroscopic aquatic organisms of industrial sewage was proved, expressed as quantitative and qualitative biocenotic changes in the river. On the basis of the above mentioned data, the influence of industrial and municipal sewage on the Sola River was determined, and it was proved that from its sources to the outlet of sewage from the brewery in Zywiec, as well as from the dam in Porabka to its mouth, the river flows with very pure water. The sector between the outlet of sewage from the brewery in Zywiec to Tresna shows a variable degree of contamination; highest was noted in the vicinity of the town Zywiec below the sewage outlet from the Zywiec plants. The Sola River, due to its natural character and high self purification capabilities, rapidly liquidates - as has been proved by investigations - all impurities, so that its waters below the dam in Porabka resemble those of the pure upper course. (Auth. summ.)

2619. Stangenberg, M. 1958. THE CHEMICAL COMPOSITION AND THE BACTERIOLOGICAL CONTAMINATION OF THE NIEMEN RIVER WATERS. (SKŁAD CHEMICZNY I BAKTERIOLOGICZNE WSKAZNIKI ZANIECZYSZCZENIA WOD RZEKI NIEMNA. (In Polish with Russian and English summ.) Polskie Arch. Hydrobiol. 4: 67-121; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32569. 1959.

Investigations were made on the chemical composition and bacteriological contamination of waters of the Niemen River during summer (June 17 - July 7, 1939) on a 385 km stretch between Stołpce and Druskienniki. Water samples were taken at 20 points. During the period of investigations the Niemen River was at 1 of its average low summer levels. The flow at Stołpce was about 7 m^3/sec. at Grodno - about 114 m^3/sec. The average velocity of the current varies from 0.28 to 0.78 m/sec. The drainage area of the river consists of a layer of post-glacial clay mainly covered with forests. The banks of the river are in general sandy-clay or sandy, often high and steep, sometimes flat barren. The river bottom is in general sandy. Impurities in the river can come from the towns Stołpce, Grodno and Druskienniki, and also from the fiber-board plant Mosty; in this respect a certain influence is exerted especially by the rivers Ros, Swisłocz, Dzitwa and Kotra, which can bring sewages from industrial centers located at some distance. The majority of industrial plants are tanneries. An analysis of this area shows that the upper part of the Niemen River is under the influence of drainage from forests, meadows, bogs and extensive peat - lands lying in the drainage area (especially the sector around the mouth of the Szubino-Niemen, Zolto-Niemen canals and the Berezyna River). The investigation stretch is under the influence of forests, especially in its upper and lower parts. The middle part of the course (before Grodno) is subject to argilotrophic influences of the clayey banks. Below Niemnowo the Niemen River is under the influence of the Augustow wilderness and of drainage from the Suwalki - Augustow lake district. The part played by different industrial centers in contaminating the Niemen

River is difficult to determine, depending upon their individual character; some of these plants were operated seasonal. The influence of these centers on the Niemen River during the period of observations was determined by investigating the water composition of tributaries of the Niemen (Swisłocz, Kotra, Rotniczanka), and by comparing the water composition of this river above and below the mouth of the tributaries. (From auth. summ.)

2620. Stangenberg, M. 1958. A GENERAL OUTLOOK ON THE CHEMICAL COMPOSITION OF RIVER WATERS IN POLAND. (OGOLNY POGLAD NA SKŁAD CHEMICZNY WOD RZECZNYCK POLSKI. (In Polish with Russian and English summ.) Polskie Arch.Hydrobiol. 4: 289-349; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32570. 1959.

The chemical composition of river waters in Poland was characterized by studying Polish literature dealing with this subject. It was proved that the chemical composition of river waters is subject to notable variation, especially along their course and during the year. The causes of this variation were discussed. This variation changes markedly with the level of waters, inflow of sewages and biological processes. A certain basic and relative chemical composition of river waters is formed depending upon the geological and soil properties of the drainage area. This composition is similar in drainage areas of similar type. Polish river waters are characterized by the predominance of carbonates and calcium, the content of sulphates, chlorides and silicates, sodium, magnesium and potassium is comparatively small. (From auth. summ.)

2621. Hiyama, Y., T. Kusaka, and K. Kondo. 1957. DIFFERENCES ON THE FREQUENCY OF FISHES AMONG SEVERAL KINDS OF COLOURS FOR UNDER-WATER FENCING NET. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 22, No. 10, pp. 598-601; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32581. 1959.

Experiment performed to determine the comparative influence of several colors of fishing nets upon the movement of fish. A white rectangular tank was used with tin plates of various colors used as a divider in the center of the tank with a 6-m clearance between the water surface and the plate. Ten fish, Acheilognathus lanceolata, were released in one end of the tank and the number counted that passed over the dividing plate in 10 minutes. This was repeated 29 times and averages of transfer for each color were tabulated. Black, red and yellow had significantly less stopping effects against transfer of the fish than did white and blue. (R. A. C.)

2622. Hiyama, Y., T. Kusaka, and K. Kondo. 1957. DIFFERENCE ON THE FREQUENCY OF TRANSFER OF FISHES WITH DIFFERENT DEGREES OF INCLINATIONS OF UNDER-WATER FENCING NET. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 22, No. 10, pp. 602-604; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32582. 1959.

The experiment on inclinations of a fish net was done in a water tank to observe the frequency of transfer of fishes over several models of fencing net. The tank was of wood, 72 by 52 cm, with water 20 cm deep, white inside. The fish used were 10 Acheioognathus lanceolata (Yari-tanago) with an average total length of 4.5 cm. As a model of underwater fencing nets, 4 tin plates painted white were bent at 90°, 60°, 45°, and 30° of facial angle against the horizontal surface and they were kept at a height of 14 cm, leaving a space of 6 cm between the water surface and the top of plate. The number of transfer of fishes over the tin plate in 10 minutes were counted for each inclination. This was repeated 10 times during a period of several days. These averages, when compared with each other, show significant differences. The 90° plate had more stopping effect than any of the others. Decreasing the inclination of underwater fencing net has less stopping effect against the transfer of fishes; instead it accelerates the transfer. (Auth.)

2623. Hoshina, T., and T. Chiba. 1957. ON THE BACTERIOSTATIC POWER OF MALACHITE GREEN AGAINST THE CAUSATIVE BACTERIA OF VIBRIO-DISEASE OF RAINBOW-TROUT. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 23, No. 4, pp. 199-201; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32583. 1959.

A series of test tubes containing 0.0020~0.010 mg malachite green (at 0.0005 mg intervals) made by adding 0.1 cc aqueous solution of malachite green in concentration 0.02~0.10 mg/cc, to 9.9 cc bouillon, was prepared. Several tubes containing 9.9 cc bouillon and 0.1 cc sterile distilled water served as controls. Tubes were inoculated with bacteria from agar slope culture, which were suspended in physiological salt solution (2 mg/10 cc) and they were cultured for 24 hours at 22°C. Growth of bacteria in each medicated tube was measured by comparison with that of the control tubes which were regarded as 100% growth. Growth at a concentration of 0.002 mg malachite green to 10 cc broth and at 0.01 mg to 10 cc was 100% and 0%, respectively. The concentration of malachite green required to check the growth in 50% was calculated as 0.052 mg/10 cc broth. (Auth.)

2624. Johnson, Leon D. 1958. POND CULTURE OF MUSKELLUNGE IN WISCONSIN. Tech. Wildlife Bull. Game Management Div., Wisconsin Conservation Dept. 17. 1-54; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32587. 1959.

The basic food for the muskellunge is provided by zooplankton culture. Daphnia pulex is selected primarily because it will eat organic detritus. Torula yeast is used as a direct food for the Daphnia thus circumventing many steps in the food chain. Fish forage is provided by the propagation of suckers and other fishes. Fathead minnows are trapped during winter months from freeze-out waters and stocked in outlying ponds to provide a natural brood stock of forage fishes. In summer months minnows

are hauled to supply forage for hatchery ponds that have a low supply. Ponds are filled late in the spring to retard the appearance of undesirable rooted aquatic vegetation, filamentous algae and predator insect larvae. Ponds are maintained at a high water level to maintain more stable warm water temperatures that favor development of the zooplankton. Management includes such chemical controls as the eradication of vegetation to prevent absorption of fertilizers. Sodium arsenite applied to the dried pond bottom eradicates the needle rush, while Dowpon is effective for cattail control. Torula yeast used as a fertilizer acts to inhibit growth of filamentous algae. Filamentous algae are eradicated by spot application of the algicide Delrad. Fuel oil applied to the water surface is used to kill the predaceous dytiscid insect larvae. Adult muskellunge spawners are captured in the spring from lakes that provide the earliest and largest muskellunge eggs. Spawning methods are similar to those used for other fish species. Muskellunge are stocked in rearing ponds after the fry reach a "swim-up" stage. Extended periods of cold water (50°F) delay muskellunge development and retard the fry so that they do not swim up. Sucker fry, used as forage, are stocked in rearing ponds four to eight days later than the muskellunge to minimize competition for the same forage. The later sucker stocking retards their growth, so that the muskellunge continue to eat the smaller-sized suckers. Pond temperatures over 85°F cause sucker mortalities. Muskellunge are harvested from hatchery ponds manually with a dip net two to three weeks after they have been stocked. Reduction of the population leaves more food for the remaining fish. Survival of the young muskellunge ranges from 30 to 70%. The 2d and final harvest is made from all ponds beginning mid-September through October. Ponds are drained to capture the 4-5 1/2-month muskellunge that range from 7-17 inches in length. The survival of muskellunge in outlying ponds has averaged 30%. (R. L. H.)

2625. Jones, J. W. 1953. SALMON STUDIES, 1951. Min. Agric. and Fish. (Gt. Brit.) Fish. Invest. Ser. I, Vol. 5, No. 6, pp. 1-16; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32588. 1959.

Salmon of the Cumberland Derwent, 1951, Cheshire Dee, 1937-1951, and Salmon and Sea Trout of the Esk (N. Yorks), 1950 are discussed.

2626. Kusaka, Takaya. 1957. TWO EXPERIMENTS TO SEE THE EFFECT OF MESH SIZE OF NETS ON DRIVING A SCHOOL OF FISH TO A CERTAIN POINT. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 22, No. 11, pp. 662-667; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32589. 1959.

Experiments were done with 10 goldfish, Carassius auratus, of an average total length of 4 cm. They were liberated in a wooden tank 150 cm long, 26 cm wide and 8 cm water depth. For model nets, 8 wooden frames were made and fine cotton thread was stretched vertically on each frame at intervals of 0.75, 1.25, 1.50, 2, 3, 4 cm except the 8th one which was a wooden frame without thread. Two methods, namely, "Centralizing method" and "Driving to one side method" were applied. The 1st method was to drive fishes towards the center of the tank from either side with 2 frames of different meshes, each at a driving speed of about 10 cm/minute. The number of fish which passed through each frame were counted. This was repeated 20 times, using the same combination of frames. The total number of fish which passed through the frame to either side was then counted. The same procedure was repeated using all 8 frames, and in all combinations of 2 frames each. The 2d method is to drive fishes to one side of tank from the other side by one frame with a speed of 10 cm/minute. When the fishes are driven up to certain position, the fishes start to turn back, passing through the frame. The numerical values were converted into common logarithms to get their mean values and to compare them. It was found that a significant difference exists in almost all combinations when examined by the F-table of statistics. (Auth.)

2627. Kusaka, Takaya. 1957. EXPERIMENTS ON THE EFFECT OF COLOR OF NETS BY THE CENTRALIZING METHOD AND THE DRIVING TO ONE SIDE METHOD. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 22, No. 11, pp. 668-673; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32590. 1959.

Ten goldfish, Carassius auratus, of an average total length of 4 cm were liberated in a wooden tank of 150 cm long, 26 cm wide and 8 cm water depth. For model nets, 8 wooden frames were made and vinyl tubing stretched vertically at intervals of 2 cm on each. The colors were of semi-transparent, yellow, white, green, pink, red, and blue. The centralizing method was repeated 40 times using all 8 frames, and in all combinations of 2 frames each. In driving fishes in the two experiments, the frames of blue, pink and red are obviously more effective than the frames of white, yellow, semi-transparent and white cotton thread. (Auth.)

2628. Kusaka, Takaya. 1957. EXPERIMENTS TO SEE THE DIFFERENT EFFECTS OF NET ON DRIVING, SEVERAL SPECIES OF FISH. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 23, No. 1, pp. 1-5; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32591. 1959.

The author used a net of white vinyl tubes to drive 5 spp. of small fishes in a tank. Goldfish (Carassius auratus) and carp (gold variety, Cyprinus carpio) were comparatively hard to drive. The killifish (gold variety) Oryzias latipes, the bitterling Acheilognathus lanceolata and the common fresh water goby, Chaenogobius annularis urotaenia were easy to drive. (G. G.)

2629. Nakamura, N., and S. Kasahara. 1957. A STUDY OF THE PHENOMENON OF THE TOBI-KOI OR SHOOT CARP--III. ON THE RESULT OF CULTURING THE MODAL GROUP AND THE

GROWTH OF CARP FRY REARED INDIVIDUALLY. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 22, No. 11, pp. 674-678; Biological Abstracts, Vol. 33, No. 9, Abst. No. 32594. 1959.

"Shoot" carp individuals which make exceptionally fast growth are already recognizable among the 20-day-old fry. Their occurrence is fostered by certain feeding conditions. The occurrence of the shoot carp was examined by culturing the "modal" group of the 70-day-old fry from one batch, and of year-old seed carp. In a modal group, obtained by excluding "shoot" individuals, the length distribution is almost symmetrical with a small standard deviation. When these modal groups were cultured for 3-12 months, their body length distribution became considerably skewed, showing that shoot carp had occurred anew. Shoot carp occur to a greater degree when the 70-day-old fry are grown, (cultured) than in the case of the year-old carp. When individual carp fry of a batch are put in separate vessels and reared with sufficient diet, unaffected by the mutual competition for food, growth of the fry is quite uniform: no shoot carp occur at all. This suggests that food competition causes the phenomenon of the shoot carp. (Authors)

2630. Oguri, M., and T. Hibiya. 1957. STUDIES ON THE ADRENAL GLAND OF TELEOSTS-II. ON THE ADRENAL TISSUES IN 15 SPECIES OF FISHES-II. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 23, No. 3, pp. 144-149; Biological Abstracts, Vol. 33, No. 9, Abst. No. 33449. 1959.

Histological observations were made on acidophil cells and chromaffin cells in the head kidneys and on the Stannius bodies of 15 species of teleosts. Surrounding the cardinal veins and its branches in the head kidneys, the acidophil cells are found as densely packed cell groups or as irregular cell cords. Chromaffin cells appear in the walls of cardinal veins and its branches, and sometimes scattered in the acidophil cell groups. Acidophil cells are stained deeply with eosin and contain a relatively large round or oval nucleus, in which a well defined nucleolus and a small quantity of chromatin are found. Chromaffin cells stain faintly with eosin. The nuclei of chromaffin cells are oval or irregular in shape and larger than those of acidophil cells. Six types of acidophil and chromaffin cell distributions are distinguished. In Anguilla japonica both cells are confined within the wall of the sinus vein near the head kidney. The histological structures of the Stannius bodies show little variation in the different species of teleosts. The cells of Stannius bodies contain many siderophil granules, which stain well with iron-hematoxylin, azocarmine, ponceau 2R or eosin; these granules are PAS-positive, but contain no lipids. (Auth.)

2631. Tamura, Tamotsu. 1957. A STUDY OF VISUAL PERCEPTION IN FISH, ESPECIALLY ON RESOLVING POWER AND ACCOMMODATION, Bull. Japanese Soc. Sci. Fish., Vol. 33, No. 9, pp. 536-557; Biological Abstracts, Vol. 33, No. 9, Abst. No. 33569. 1959.

Three properties of the eye which are important in visual acuity were investigated: the resolving power of the dioptric system, the resolving power of the retina, and the extent of accommodation. The resolving power of the crystalline lens, the only dioptric element responsible for image formation in fishes, ranged 54-90 seconds of arc for lenses over about 5 mm in diameter. Cone density varies by species and by regions of retina. The best retinal acuity was 4.2 minutes of arc, so that the retina, not the lens, limits visual acuity. All eyes examined were either emmetropic or hypermetropic in untreated living fish which were fixed rigidly in a tank between 2 pieces of rubber sponge, but become myopic in certain directions upon injection of atropine or curare, or upon sectioning of the optic nerve. The axis of greatest accommodation was lower-fore in Pagrosomus, Sparus, Evynnis, Leiognathus and Xesurus; fore in Epinephelus, Sebastiscus, Therapon, Girella and Pseudoblennius; and fore-fore upper or upper-fore in Lateolabrax and Trachurus. These axes are usually served by the retinal region of highest cone density. There is a relationship between attachment points of the suspensory ligament and retractor lentis and the axis of accommodation. From this relationship and the region of highest cone density, the visual axis was determined for some species not available in living condition. They are: fore in Cantherines, Helicolenus, and Scomber; upper-upper-fore in Priacanthus, Malakichthys, Zenion, Chlorophthalmus, and Argentina. The binocular field tends to be broadest in the direction of the visual axis. (Auth. abst.)

2632. Ogino, C., and M. Suyama. 1957. VARIATIONS IN AMINO ACID COMPOSITION OF PROTEIN DURING THE DEVELOPMENT OF EGG AND THE GROWTH OF YOUNG FISH OF RAINBOW TROUT, SALMO IRIDEUS. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 23, No. 4, pp. 227-229; Biological Abstracts, Vol. 33, No. 9, Abst. No. 33987. 1959.

Regarding the amino acid composition of unfertilized egg protein, there is little difference between rainbow trout and brook trout. The development of rainbow trout egg shows little change in the amino acid composition of the total protein. In the period from hatching of the egg to the 1st feeding of the fry, body protein undergoes some variation in amino acid composition, among which decrease of alanine and increase of glycine are most notable. The amino acid composition of the body protein of fingerlings, however, does not exhibit any appreciable variation during their growth, except for glycine content. On the basis of the amino acid composition of body protein of growing fingerlings, the most suitable amino acid composition of the diet for fingerlings of rainbow trout is discussed. (Authors)

2633. Kriss, A. E., and I. N. Mitskevich. 1959. KRASSILNIKOVIAE: A NEW CLASS OF MICRO-

ORGANISMS FOUND IN SEA AND OCEAN DEPTHS. Jour. Gen. Microbiol., Vol. 20, No. 1, pp. 1-12; Biological Abstracts, Vol. 33, No. 9, Abst. No. 34142. 1959.

A new class of micro-organisms, the KRASSILNIKOVIAE, found in the Black Sea, the Pacific and the Arctic Oceans, is described. These organisms developed on slides immersed in the waters; they have not been cultivated in the laboratory. They consist of non-branching, non-septate filaments with a head at one end consisting of a cluster of round bodies. The filaments often become interlaced and form strings which can just be seen by the naked eye. They may or may not be contained in a sheath. Comparisons are made between the Actinomycetes, Eubacteriae, Myxobacteriae, Spirochaetaceae, and the new class. The new class is believed by the authors to occupy an intermediate position between the protozoa and the bacteria. (R. C. S.)

2634. Van Overbeek, J., W. J. Hughes, and R. Blondeau. 1959. ACROLEIN FOR THE CONTROL OF WATER WEEDS AND DISEASE-CARRYING WATER SNAILS. Science, Vol. 129, No. 3345, pp. 335-336; Biological Abstracts, Vol. 33, No. 9, Abst. No. 34405. 1959.

Injection of the biocide acrolein into irrigation canals killed submersed weeds, thereby reducing flow resistance and increasing capacity. In a 20-mile canal, 150 gallons raised throughout from 311 to 552 ft.^{3}/sec. Acrolein also effectively eradicated aquatic snails; it promises to become a useful tool in the battle against Schistosoma blood flukes. (Auth. abst.)

2635. Bargetzi, J.-P. 1958. APPLICATION OF A BIOCHEMICAL METHOD OF ANALYSIS TO A TAXONOMIC STUDY: THE COREGONES OF LAKE NEUCHATEL. II. CYTOLOGY AND DOSAGE OF DNA. (APPLICATION DE METHODES D'ANALYSE BIOCHIMIQUE A UNE ETUDE TAXONOMIQUE: LES COREGONES DU LAC DE NEUCHATEL. II. CYTOLOGIE ET DOSAGE DE DNA.) Experientia, Vol. 14, No. 12, pp. 445-447; Biological Abstracts, Vol. 33, No. 9, Abst. No. 35763. 1959.

Two closely related forms of Coregonus from Lake Neuchatel were examined cytologically and biochemically, in order to ascertain the chromosome number and the DNA content of haploid and diploid nuclei. Coregonus fera has 2 N = 78+ $\pm$ 2 chromosomes, and a DNA content (diploid) of 5.8×10^{-9} mg; Coregonus macrophthalmus, 2 N = 78+ $\pm$ 3, DNA content of 6.1×10^{-9} mg. These results do not support the hypothesis which postulates that polyploidy may be a determining factor in the speciation of these fishes. (Authors)

2636. Wennekens, M. P. 1959. WATER MASS PROPERTIES OF THE STRAITS OF FLORIDA AND RELATED WATERS. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 9, No. 1, pp. 1-52.

The hydrography of the Straits of Florida is greatly influenced by a flow of water originating in the Caribbean-Gulf of Mexico region and to a lesser extent by waters of the Western Atlantic. The Caribbean or Yucatan Water, identified by its well-defined salinity maximum, is found along the entire insular margin of the Florida Current. Evaporation and seasonal cooling modify the upper 300 m of the original Yucatan Water, creating new water masses in the northern and western Gulf of Mexico. The Continental Edge Water, a water mass somewhat intermediate between Yucatan and Western Gulf Waters, becomes well-differentiated in the eastern Gulf, being easily identified by temperature-salinity and oxygen-density relationships. The Continental Edge Water is found along the continental margin of the Florida Current throughout the length of the Straits. The influx of Western Atlantic Water is frequently observed in the northern Straits of Florida off Bimini, being detected by its higher oxygen content; it is restricted to a narrow band along the Bahama Banks. The study of oxygen distribution shows that Western Atlantic Water intermixes with the waters flowing out of the Straits of Florida. Present information on dissolved inorganic phosphate is too unreliable to permit a critical study of its distribution. The Straits of Florida are part of an extensive sill preventing interchange of waters from depths greater than about 800 m between the Gulf of Mexico and the Atlantic Ocean. The sill depth of the Straits of Florida and portions of the Blake Plateau is slightly below the average depth of the oxygen minimum and is exactly within the average depth of the dissolved inorganic phosphate maximum. (Auth. abst.)

2637. Lewis, Alan G. 1959. THE VERTICAL DISTRIBUTION OF SOME INSHORE COPEPODS IN RELATION TO EXPERIMENTALLY PRODUCED CONDITIONS OF LIGHT AND TEMPERATURE. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 9, No. 1, pp. 69-78.

An experimental tower was used to test the effects of different gradients of light and temperature on the vertical distribution of three species of planktonic, inshore copepods. The three species used in the experimental tests were Acartia tonsa Dana, 1849, Paracalanus parvus (Claus, 1863), and Calanopia americana Dahl, 1894. Data indicated an optimum temperature range, outside of which there is a correlation between the occurrence of copepod concentrations and illumination. (Auth. abst.)

2638. Klawe, Witold L., and Bell M. Shimada. 1959. YOUNG SCOMBROID FISHES FROM THE GULF OF MEXICO. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 9, No. 1, pp. 100-115.

Examination of some fish collections, made in the Gulf of Mexico from June, 1954 to August 1956 by personnel of the United States Fish and Wildlife Service, have resulted in the separation and identification of young forms of several tuna and tuna-like species. These include the yellowfin tuna (Thunnus argentivittatus), blackfin tuna (Thunnus atlanticus),

oceanic skipjack (Katsuwonus pelamis), little tunny (Euthynnus alletteratus), frigate mackerel (Auxis thazard), and bonito (Sarda sarda), as well as a few small specimens of Thunnus of indeterminate species. The methods of diagnosis employed are discussed, and some species are described and illustrated.

The capture of these young fishes indicates that several scombroid species spawn in the Gulf of Mexico at various times of the year. (Auth. abst.)

2639. Longhurst, Alan R. 1958. RACIAL DIFFERENCES IN SIZE AND GROWTH IN THE NEW ZEALAND SNAPPER. New Zealand Journal of Science, Vol. 1, No. 4, pp. 487-499.

The snapper is most heavily exploited in New Zealand on the grounds near the centres of population in the north, and subjective evidence suggested that here the stocks were composed of smaller fish than elsewhere.

A preliminary survey of size frequency distribution and growth rates shows that there is, indeed, a progressive decline in the average length of the fish in the southern large-fish stocks, while the relative growth rate is similar in both stocks. Snapper may be relatively sedentary, tagging giving no evidence of long migrations, and it is suggested that the differences observed in size and growth, together with differences in relative growth of scales are more likely to be due to local racial differences rather than to the effects of over-exploitation. (Auth. summ.)

2640. Burnet, A. M. R. 1959. ELECTRIC FISHING WITH PULSATORY DIRECT CURRENT. New Zealand Journal of Science, Vol. 2, No. 1, pp. 46-56.

The attractive effect on fish of pulsatory direct electric current is a combination of electrotaxic and forced swimming. With trout, the most efficient pulse frequency for electronarcosis and electrotaxis is between 50/sec and 100/sec, while for forced swimming it is between 2/sec and 5/sec.

A dual frequency pulse is described and is the most efficient of a number of pulse types used in field trials. (Auth. summ.)

2641. Ryan, James H. 1959. CALIFORNIA INLAND ANGLING ESTIMATES FOR 1954, 1956, AND 1957. California Fish and Game, Vol. 45, No. 2, pp. 93-109.

Postal card and/or letter-type questionnaires were sent to a stratified random sample of California angling license holders to determine catch trends and angler days expended in 1954, 1956, and 1957. About 30 percent of the questionnaires were returned each year.

Tabulation of returned questionnaires revealed trout to be consistently the most important fish in both number caught and in days expended to catch them. Others, by decreasing numbers caught, were panfish, catfish, black bass, striped bass, ocean salmon, steelhead, and river salmon.

The total catch of trout is apparently increasing each year. The total catch of striped bass has shown a steady decline until 1957, which witnessed the best catch in 17 years. Salmon fishing has shown a steady decline overall, since the alltime peak of 1954. Steelhead fishing has shown an increase in total catch somewhat paralleling that of trout. The black bass and catfish catches have remained relatively stable during the survey period. (Auth. summ.)

2642. Fisk, Leonard O. 1959. EXPERIMENTS WITH A VERTICAL BAFFLE FISHWAY. California Fish and Game, Vol. 45, No. 2, pp. 111-122.

Construction of the Delta Water Project in the Sacramento-San Joaquin Delta will result in physical barriers placed in channels currently used by anadromous fish populations of the Central Valley. Several of the species involved - namely, striped bass, American shad, and white sturgeon - are reluctant to use fishways of the type currently in use in California. Because of this, a vertical baffle fishway was constructed for testing these species to determine if they would utilize a fishway of this design.

Results of the experiments indicate that some individuals of all the species tested will use a vertical baffle fishway under captive conditions. Sixty percent of the white catfish, 60 percent of the steelhead, 67 percent of the king salmon, 22 percent of the striped bass, 32 percent of the American shad, and 20 percent of the white sturgeon used were successful in passing upstream through the fishway. (Auth. summ.)

2643. Eipper, Alfred W. 1959. EFFECTS OF FIVE HERBICIDES ON FARM POND PLANTS AND FISH. New York Fish and Game Journal, Vol. 6, No. 1, pp. 46-56.

This paper summarizes data obtained from applications of five different herbicides in central New York farm ponds over a 3-year period. Delrad, Fermate, Phygon-XL, copper sulfate, and sodium arsenite were the chemicals employed. Available information deals chiefly with effects of these herbicides on algae, submersed aquatics, and various sizes and species of fish in 30 farm ponds which received a total of 70 herbicide applications. Ranges in physical-chemical determinations in 16 of these ponds were: pH, 7.6-8.8; total alkalinity, 60-170 p.p.m.; surface water temperature, 63°-83° F.; and bottom temperature 60°-79° F. When applied as surface sprays to produce a pond-water concentration of 0.5 p.p.m. active ingredient by weight, Delrad, Fermate, and copper sulfate were all equally effective in controlling unbranched filamentous green algae. With respect to treatment cost and safety of small fish, copper sulfate had definite advantages over Delrad or Fermate. Tests of Phygon in seven ponds were inconclusive, indicating only that 0.25 p.p.m. concentration of this chemical killed neither fish nor plant growths. Sodium arsenite at 4 p.p.m. controlled Hydrodictyon and Cladophora (branched algae little affected by the other chemicals tested) as well as other algae and various submersed rooted aquatics in 10 ponds. Information on the effects of different concentrations of Delrad on three types of

algae and two age groups of minnows was obtained in 10 ponds, together with physical-chemical determinations. The inconclusive nature of these data, due primarily to the confounding of a number of variables, clearly demonstrates the need for careful experimental design in planning field tests of aquatic herbicides, with adequate provisions for controls, replicates, and measurements of results. (Auth. abst.)

2644. Metcalf, Artie L. 1959. FISHES OF CHAUTAUQUA, COWLEY AND ELK COUNTIES, KANSAS. University of Kansas Publications, Museum of Natural History, Vol. 11, No. 6, pp. 345-400.

2645. Minckley, W. L. 1959. FISHES OF THE BIG BLUE RIVER BASIN, KANSAS. University of Kansas Publications, Museum of Natural History, Vol. 11, No. 7, pp. 401-442.

2646. Ross, Robert D. 1959. GAME FISH STREAMS AND RECORDS OF FISHES FROM THE POTOMAC-SHENANDOAH RIVER SYSTEM OF VIRGINIA. Technical Bulletin 140, Virginia Agricultural Experiment Station, Virginia Polytechnic Institute, 20 pgs.

2647. deSylva, Donald Perrin. 1959. THE LIFE HISTORY AND SYSTEMATICS OF THE GREAT BARRACUDA, SPHYRAENA BARRACUDA (WALBAUM). Dissertation Abstracts, Vol. XIX, No. 9, p. 2409.

The great barracuda, Sphyraena barracuda (Walbaum), family Sphyraenidae, is found in all tropical seas, with the exception of the Eastern Pacific. The following nominal species are considered as synonyms of barracuda Walbaum, 1792: picuda Bloch and Schneider, 1801; becuna Lacepede, 1803; barracuda Shaw, 1804; barracuda Cuvier, 1829; commersoni Cuvier, 1829; dussumieri Cuvier, 1829; agam Ruppel, 1835; affinis Ruppell, 1835; nuageuse Lienard, 1843; picuda Poey, 1866; snodgrassi Jenkins, 1901; and akerstromi Whitley, 1947. S. kadenar Montrouzier, 1857, and microps Marshall, 1853, are probably synonyms.

Barracuda were collected off Miami, Florida, from Bimini, Bahamas, and specimens from the Danish Oceanographical Expeditions in the Western Atlantic were used. Ontogenetic variation in proportional measurements was determined for 171 specimens from 5.5 to 1111 mm. standard length. Keys for identification are presented for barracuda, guachancho, picudilla, borealis and sphyraena.

Most males of barracuda mature at two years and all mature by three years. Some females mature at three years, and all mature at four. The spawning season is from April until October off southern Florida. Spawning was not observed but probably occurs in the open ocean. The eggs were not identified from plankton tows. Postlarvae were taken far from shore and near the surface, over depths of 200 to 5200 meters.

Age analyses were based upon the scale readings of 555 barracuda, back-calculated lengths from scale measurements, and upon modes in the length-frequency distributions of 2707 specimens from southern Florida. It attains 10 to 12 inches at the end of the first winter, and 18 to 22 inches at the end of its second. It reaches an age of at least 14 years. Maximum length is about 6 feet and a weight of more than 100 pounds.

The young barracuda drifts inshore in spring, spends its first summer in shallow nursery areas, and moves offshore to somewhat deeper water in late fall. During the second summer, it enters the mangrove habitat or the deeper weed beds. In the third year it enters the coral-reef habitat. The barracuda migrates seasonally along both coasts of Florida. Some individuals may drift far out to sea.

Young sometimes occur in loose aggregations, but the adults are solitary. Peck order was observed among individuals from 300 to 400 mm. long which were confined in a tank.

Young feed upon atherinids, gobiids and clupeids. Tetraodontiform fishes, hemirhamphids and carangids were most commonly taken by the adults. A change from a shallow-water habitat to that of a reef existence is accompanied by a change in food habits.

A summary of the 21 attacks reputedly made by barracuda on humans is presented and analyzed. Underwater experiences with barracuda are discussed in relation to the factors which are favorable to an attack.

Poisoning in humans who have eaten fresh barracuda is due to a toxin in the flesh and not from bacterial poisoning. In the Western Atlantic, poisonings have occurred from February to November. There seems to be no relation between the attainment of maturity or the spawning cycle, and the poisonous nature of barracuda flesh. Some 58 per cent of the stomachs of adult barracuda contained fishes which are reputedly toxic, of which 20 per cent were tetraodontiform fishes. Evidence is presented for a food-chain origin of the toxin, and mechanisms are discussed for the transmission of the toxin from planktonic and benthic algae to barracuda by way of intermediate organisms. Variations in hydrographic meteorological features are believed to result in distinct temporal and spatial variation in the toxicity of barracuda as well as other fishes.

2648. Sroufe, Stanley Alexander, Jr. 1959. STUDIES ON THE MORPHOLOGY AND DEVELOPMENT OF MAZOCRAEOIDES OLENTANGIENSIS N. SP. (TREMATODA:MONOGENEA), A PARASITE OF THE GIZZARD SHAD, DOROSOMA CEPEDIANUM (LE SUEUR). Dissertation Abstracts, Vol. XIX, No. 10, p. 2696.

Mazocraeoides olentangiensis n. sp. (Trematoda: Monogenea), a parasite of the gills of the gizzard shad, Dorosoma cepedianum (le Sueur), has been described in detail. This trematode, a member of the family Mazocraeidae, was found on the gills of 112 of 164 (68.2 percent) of the fish host. M. olentangiensis is similar to other members of the genus in that the shape of the body is clavate and the

anterior pair of clamps is near the middle of the body. The clamp structure of this species is similar to and homologous with that described by Llewellyn for Kuhnia scombri (Kuhn, 1829) Sproston, 1945. The genital corona is armed with five longitudinally arranged, S-shaped hooklets and two larger lateral hooklets. The ovary is looped, consisting of a descending and an ascending limb, whereas the testis is saccate and located lateral to the ovary. As in other members of Mazocraeoides the vaginal pore is located mid-dorsally. Its duct extends posteriorly in the midline, then laterally, and joins the left (or right in some specimens) vitelline duct; as a result, the vitelline reservoir acts as a seminal receptacle.

In addition to the growth of the body and assumption of the definitive shape, development in this species is characterized by loss of certain larval structures, the metamorphosis and growth of other larval parts, and also the formation of new ones. The development of M. olentangiensis has been divided into a series of stages. The stages have been designated as follows:

First-stage larva - the oncomiracidium.

Second-stage larva - the stage following the shedding of the ciliated covering of the oncomiracidium.

Third-stage larva - the stage initiated by loss of the fourth (posterior) pair of lateral larval hooklets and the formation of the fourth (posterior) pair of clamps.

Fourth-stage larva - the stage characterized by the loss of the third pair of hooklets and the formation of the third pair of clamps.

Fifth-stage larva - the stage characterized by the loss of the second pair of hooklets and formation of the second pair of clamps.

Sixth-stage larva - the stage characterized by loss of the first pair of hooklets and the formation of the first pair of clamps.

Juvenile stage - the stage immediately preceding the formation of ova, sperm, and mature vitelline cells. This stage terminates with the appearance of fertile ova.

Adult - the stage characterized by formation of fertile ova.

2649. Crossman, E. J. 1959. DISTRIBUTION AND MOVEMENTS OF A PREDATOR, THE RAINBOW TROUT, AND ITS PREY, THE REDSIDE SHINER, IN PAUL LAKE, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 3, pp. 247-267.

Predatory rainbow trout, while not confined to any part of the lake, appear to move into areas of greatest shoal development at a time when their prey, redside shiners, are most heavily concentrated there. A complex movement pattern apparently governed by shoal water temperature leads to a seasonal distribution of shiners which brings the prey into contact with the predator in midsummer.

Distribution of the prey on the shoals around the lake shows prey to be most heavily concentrated over areas of extensive shoal and only small numbers present along steep shore areas. In areas of heavy concentration shiners show a definite vertical and horizontal distribution of sizes; the larger prey always found farther from shore or deeper than smaller shiners. In addition, there are vertical seasonal movements of shiners at shoal edge and a diurnal pattern of movement from shoal to deep water after dark.

The effect of the movement patterns of predator and prey are manifested in the diet of the trout. In August, shiners constitute over 90% of the diet of predatory trout (those over 10 inches in length), but shiners are a negligible item in the winter diet. (Auth. abst.)

2650. Crossman, E. J. 1959. A PREDATOR-PREY INTERACTION IN FRESHWATER FISH. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 3, pp. 269-281.

The predator-prey interaction of rainbow trout, Salmo gairdneri Richardson, and the redside shiner, Richardsonius balteatus (Richardson), in Paul Lake, British Columbia, depends on such factors as distribution and movements of predator and prey, behaviour of predator and prey, lake morphometry, shoal water temperature and characteristics of the fish.

In adult trout, activity associated with predation follows a stereotype pattern. Behaviour may also be responsible for the fact that trout under 10 inches in length do not utilize, as food, even small shiners to any extent, even though under laboratory conditions they will kill and eat them. The estimated annual kill of shiners by predatory trout is 150,000 and the shiner population is probably in the millions. Shiners preyed on are such that predation appears not to limit recruitment to the prey population. Shortly after their introduction to the lake shiners reduced the growth rate of small trout by competition. There is evidence that feeding on shiners now increases the growth rate of at least those trout over 14 inches whose food is as high as 98% shiners in summer. (Auth. abst.)

2651. Hourston, Alan S. 1959. EFFECTS OF SOME ASPECTS OF ENVIRONMENT ON THE DISTRIBUTION OF JUVENILE HERRING IN BARKLEY SOUND. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 3, pp. 283-308.

During the early juvenile stage, the herring in Barkley Sound move from the spawning grounds, mainly on the northwest side of the sound, to rearing grounds mainly on the southeast side. From a study of the distribution abundance and environment of the juveniles, it would appear that the herring were neither carried across the sound by prevailing currents nor were they simply following their food supply. The fish appear to have dispersed and gradually collected in the sheltered bays, inlets and channels, which are more numerous on the southeast side. Juvenile habitats generally had shallow thermoclines, medium salinities and below average zooplankton concentrations but these factors did not appear to affect the distribution of the juveniles directly. (Auth. abst.)

2652. Hourston, Alan S. 1959. THE RELATIONSHIP OF THE JUVENILE HERRING STOCKS IN BARKLEY SOUND TO THE MAJOR ADULT HERRING POPULATIONS IN BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 3, pp. 309-320.

During the summers of 1951-53, small body-cavity tags were inserted in 55,547 juvenile (1-year) herring on the lower west coast of Vancouver Island. Fifty of these tags were recovered from the catches of adult fish between 1953-54 and 1956-57. These recoveries indicated homing by sub-district (the region occupied by an adult population) to be 52% after two years at large, and 64% after three years. Comparable data for herring tagged as adults showed 82% and 81% homing respectively. The greater tendency for the immature fish to mix with other adult populations may result from the fact that these fish join adult schools when the latter are considerably dispersed and intermixed on the offshore feeding grounds. Thus, population studies linking the juvenile and adult stages may require the use of a larger basic unit of area than that encompassing the distribution of the adult population. The dimensions of this unit will depend on the local potential for intermixing of adult populations at the time of recruitment. (Auth. abst.)

2653. Miller, R. B., A. C. Sinclair, and P. W. Hockachka. 1959. DIET, GLYCOGEN RESERVES AND RESISTANCE TO FATIGUE IN HATCHERY RAINBOW TROUT. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 3, pp. 321-328.

In a stream occupied by a resident wild trout population, mortality of introduced hatchery trout is greater than when similar trout are released in a barren stream. From this it has been inferred that in the occupied stream the new comers cannot find niches and succumb to exhaustion in the open current. A conspicuous rise in blood lactic acid in planted hatchery trout supports this inference.

In the present experiment rainbow trout of identical brood stock were raised on two diets; one group received a complete dry pelleted ration, the other, ground liver. After 35 weeks the trout were subjected to varying degrees of exercise, following which blood lactate and liver and muscle glycogen were assayed. It was found that the pellet-fed trout had more glycogen stores before exercise; that during exercise this group maintained its liver glycogen but lost about half the muscle glycogen after 15 minutes of exercise. After 12 hours' rest, muscle glycogen had risen to the normal level. In the liver-fed trout liver glycogen was depleted to one-half after 15 minutes' exercise and muscle glycogen fell to one-fifth or lower. Twelve hours' rest failed to restore either liver or muscle glycogen. Prolonged exercise in a current of one mile per hour reduced glycogen to about 1/4 in the liver-fed fish; some died during the test, and none returned to normal metabolic states after 24 hours. It is concluded that exhaustion of metabolites such as glycogen plays some part in deaths of planted trout, and that the hatchery diet can materially affect the ability of the fish to survive. (Auth. abst.)

2654. Godfrey, Harold. 1959. VARIATIONS IN ANNUAL AVERAGE WEIGHTS OF BRITISH COLUMBIA PINK SALMON, 1944-1958. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 3, pp. 329-337.

Average weight data of British Columbia pink salmon, Oncorhynchus gorbuscha, since 1944 were made available by the Fisheries Association of British Columbia, and were used to compare annual changes in size among stocks throughout the Province. Adult pinks of the odd-year cycle were almost invariably larger than those of the even-year cycle. In British Columbia this cycle has also been consistently the more abundant, and in southeast Alaska these fish have been either about equally as numerous as the even-year pinks, or, upon occasion, much more numerous. The pink salmon of each of the major fishing areas in the Province show similar annual changes in average weight. From an extremely small average size in 1946 there was a trend of steady increase, among all stocks and involving both cycles over the next 8 years; this was followed by a decline in 1955 and 1956, then a further increase in 1957 and 1958. A comparison between southeastern Alaska pinks and pinks of northern British Columbia showed that they had experienced similar year-to-year weight changes during the earlier period of 1930-1939. (Auth. abst.)

2655. Briggs, John C., and Nobuo Egami. 1959. THE MEDAKA (ORYZIAS LATIPES). A COMMENTARY AND A BIBLIOGRAPHY. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 3, pp. 363-380.

A summary is presented of the most important attributes of the medaka (Oryzias latipes), from the standpoint of its usefulness as a laboratory animal. Since the medaka is by far the most popular fish for laboratory use in Japan, the bibliography presented here gives a fair idea of the extent of Japanese work in such areas as fish physiology (sensu stricto), embryology, genetics and behavior. (Auth. abst.)

2656. Fry, F. E. J. 1957. THE LETHAL TEMPERATURE AS A TOOL IN TAXONOMY. L'Année Biologique (Paris), 33 (3d series), Fasc. 5-6, pp. 205-219. (In English)

Lethal temperature determination must consider proper conditioning of test animals. The level of thermal acclimation in particular, and diet and length of photoperiod also, are known to produce variations in resistance to high and low temperatures. Unless recognized, confusion in interpretation may result.

Pure thermal death probably occurs but thermal death more likely is the result of a heterogeneity of causes. The zone of temperature tolerance has been modified experimentally by changing the mineral content, the oxygen content, and the salinity

of the water. These and other factors may act independently or combined.

Two populations having identical lethal temperatures probably have similar genetic constitution, but it is uncertain whether differences in lethal temperatures are a reflection of genotypic or phenotypic variation. It is then a question of whether the difference is a result of evolutionary change or of some prior influence of the environment.

2657. Hoy, Joe. 1959. A PORTABLE CONDUCTIVITY BRIDGE FOR FIELD USE. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 3, pp. 381-382.

This instrument is completetly transistorized, very compact, and should cost about $25. A wiring diagram is provided.

2658. Loukashkin, Anatole S., and Norman Grant. 1959. BEHAVIOR AND REACTIONS OF THE PACIFIC SARDINE, SARDINOPS CAERULEA (GIRARD) UNDER THE INFLUENCE OF WHITE AND COLORED LIGHTS AND DARKNESS. Proceedings of the California Academy of Sciences, Fourth Series, Vol. XXIX, No. 15, pp. 509-548.

The first series of experiments studied the effects on schooling behavior of pure green, blue, and red illumination as well as total darkness and flashing and constant beams of white light of low intensity in total darkness. Of the 3 colored lights, and white light, of both different and uniform light intensities, only the red elicited negative reactions; i.e., fright, partial breaking up of school and loss of equilibrium. Sudden total darkening caused complete disorganization of the school and initial shock effect of loss of equilibrium which was gradually restored; gradual darkening to almost zero produced no such results.

Feeding responses were delayed after a five-minute exposure to colored light, least in green and most in blue, but were not delayed regardless of color if exposures were lengthened to half an hour before feeding.

Flashing white light of low intensity elicited fright reactions with breaking up of the school. The same beam constantly illuminating half the tank produced no fright reaction, but in fact aided reformation of schooling.

The second series of experiments studied the ability of sardines to discriminate colors of different wave lengths. The possible combinations of red, blue, green and white light were used in 3-zone and 2-zone tests. In all combinations, the effect of red light was invariably negative in contrast to preferential reaction to others.

In 3-zone tests of red, white, and blue or green light, blue or green received the preferential positive reaction. A similar reaction was recorded for the red, blue, and green combination. The 2-zone tests produced a similar relation of reactions. In both the 3-zone and 2-zone tests, the negative effect of the red light was nearly identical. In white against blue or green tests, white received a negative reaction and blue and green positive.

These experiments revealed that the sardine is photoactic, is incapable of reacting differently to white light intensities of 0.01 to 38.9 f.c., is capable of discriminating qualitatively the colors of light of the three primary colors, is strongly negative to red light, and will tolerate red light in combination with darkness.

2659. Donaldson, Lauren R., Paul R. Olson, and John R. Donaldson. 1959. THE FERN LAKE TRACE MINERAL METABOLISM PROGRAM. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 1-6.

The role of the mineral supplements in the management of fish ponds, game ranges, and forests has been a research subject of a host of individuals and organizations for many years. Nearly all of such projects, however, have been limited by analytical techniques that can at best be applied only to the macronutriments.

The cooperative program at Fern Lake, conducted by the U. S. Atomic Energy Commission, University of Washington and the State of Washington Department of Game, embraces studies in which the total mineral need in the ecology of the Fern Lake watershed is evaluated by the use of the techniques of the radiation biologist. Using the combined skills of the physical and biological sciences it is hoped that great progress can be made in improving the productive capacity of this impoverished watershed. (Auth. abst.)

2660. Lambou, Victor W. 1959. FISH POPULATIONS OF BACKWATER LAKES IN LOUISIANA. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 7-15.

Fish populations in seven backwater lakes were sampled by rotenone poisoning. On the average, 397 pounds of fish per acre comprising 103 pounds of game fish and 169 pounds of commercial fish were recovered from the lakes. Recoveries from individual lakes ranged from 142 to 651 pounds of fish per acre. Non-predaceous fish made up 56 percent of the total population. Bluegill sunfish, warmouth sunfish, gizzard shad, fresh-water drum, largemouth bass, black crappie and spotted gar were the principal fishes in the lakes. An average of 78 pounds of available game fish (harvestable-size game fish) per acre was recovered from the lakes. Fairly large concentrations of fish occurred in relatively small areas in some of the backwater lakes. A total of 974 pounds of fish, of which 475 pounds were game fish, was recovered from a single 1-acre sampling area.

On the average, there were 1.9 pounds of non-predaceous fish per pound of predaceous fish. There were considerably less available forage fish (by weight) for the predators than they themselves made up in the population. The predaceous fish in the backwater lakes must be partly dependent on some type of forage other than fish, and swamp crayfish are probably important in their diet.

A large increase in the area of the lakes during high water periods in the spring creates a favorable

habitat for a rapidly expanding fish population. The quality of the sport fishing on the backwater lakes is excellent. (Auth. abst.)

2661. Carlander, Kenneth D. 1959. A SURVEY OF TECHNICAL FISHERY PERSONNEL. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 18-22.

A mail survey of fish conservation agencies indicated that in 1958, there are at least 1573 technical fishery personnel in United States and 232 in Canada. If classified according to major responsibility, 900 are in research, 354 in management, 249 in administration, 232 in survey and trouble-shooting, 138 in fish culture, and 32 in education. Lines between technical and non-technical personnel are difficult to draw, particularly in fish culture. State and provincial agencies hire 50.4 percent of the personnel, federal agencies 39.1 percent, colleges 8.9 percent and 1.6 percent were listed as privately employed. Over 90 percent of the personnel have college degrees and almost 44 percent have advanced degrees. Over half of those in management, survey, and research are under 35 years of age, attesting to the rapid growth of the field. Only 41 percent of those listed are members of the American Fisheries Society. About one-third of the personnel deal with marine fisheries and most of these are in research activities. Most biologists and managers hired by state conservation departments have broad responsibilities. (Auth. abst.)

2662. Henderson, C., Q. H. Pickering, and C. M. Tarzwell. 1959. RELATIVE TOXICITY OF TEN CHLORINATED HYDROCARBON INSECTICIDES TO FOUR SPECIES OF FISH. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 23-32.

Bioassays were conducted on ten commonly used chlorinated hydrocarbon insecticides to determine their comparative toxicity to fish. All of the compounds except BHC were extremely toxic to fish with 96 hour TL_m values generally below 0.1 p.p.m. Endrin was the most toxic with TL_m values ranging as low as 0.6 p.p.b. Bluegills were the most sensitive fish, followed by fathead minnows, goldfish and guppies, respectively. Changes in water quality characteristics (pH, alkalinity, hardness) had no apparent effect on toxicity. Acetone solutions and emulsible concentrates were equally toxic formulations. All of the chlorinated hydrocarbon insecticides except BHC were more toxic to fathead minnows than the most toxic of the organic phosphorus insecticides. Additional areas of needed research are suggested. (Auth. abst.)

2663. Witt, Arthur Jr., and Robert S. Campbell. 1959. REFINEMENTS OF EQUIPMENT AND PROCEDURES IN ELECTROFISHING. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 33-35.

An electrofishing device that is mounted on a boat is described. This "boom seine" is three times more efficient at night than during the day. The catch of the boom seine in a Missouri impoundment is compared with the catch from nets. It is selective toward the centrarchids (except white crappie) in waters where nets are selective toward white crappie, gizzard shad, white bass and freshwater drum. Selectivity is related to the behavior of the fishes and habitat where fishing is done. (Auth. abst.)

2664. Cressman, E. J., and P. A. Larkin. 1959. YEARLING LIBERATIONS AND CHANGE OF FOOD AS EFFECTING RAINBOW TROUT YIELD IN PAUL LAKE, BRITISH COLUMBIA. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 36-44.

Some effects of the introduction of redside shiner, Richardsonius balteatus (Richardson), on the rainbow trout, Salmo gairdneri Richardson, in Paul Lake from 1952 to 1957 are considered together with results of yearling trout liberations since 1953. Changes in the diet of rainbow trout from invertebrates to redside shiners, already noticeable in 1952, have since intensified. By 1956, shiners comprised over 90 percent of the summer diet of trout over 35 centimeters in length. In the diet of trout larger than 25 centimetres, shiners replaced plankton, amphipids and other bottom organisms to a marked degree. Trout under 25 centimetres utilized more shiners than previously, but in lesser proportion than the larger trout.

A program of yearling trout liberations since 1953 has shown considerable success, these trout forming up to eight percent of the anglers' catch in the fall of the year of liberation and as high as 50 percent in the following spring. Hatchery fish of a given age were less variable in size and grew faster than wild fish of the same age. Both wild and hatchery trout showed growth rates in their second and third years suggesting increased use of shiners as food. Wild fish which began the year at fork lengths over 17 centimetres in 1955 and 1956, had growth rates equivalent to wild fish in year prior to the introduction of shiners. The contribution of yearling liberations, growth rates of wild and hatchery trout and the effect on the fishery of the changing relations of rainbow trout and redside shiners are discussed. (Auth. abst.)

2665. Dolan, Thomas, Charles B. Wurtz, and Colton H. Bridges. 1959. SURVEY OF MULTIPLE-USE RESERVOIR PRACTICES IN THE UNITED STATES. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 45-49.

Information obtained by questionnaire is presented on the multiple-use of water-supply reservoirs. Twenty-eight United States municipalities of over 10,000 population returned completed questionnaires. Of these, 21 municipalities (75 percent) allow recreational use of some kind on 72 reservoirs having a total area of 132,379 acres. Fishing and boating are sanctioned to a certain extent by all 21 agencies, picnicking by 15, sailing by 7, camping and swimming by 2, hunting by 1, and skating by 1.

Permits are required for specific recreational use by half the municipalities permitting such uses. Permit fees range from $0.35 to $1.50 per day, $2.00 to $3.00 a month and $3.00 to $5.00 a year. The maximum fee reported is $12.50 for a seasonal boating and fishing permit. Regulations and enforcement of them vary. Half the agencies supply sanitary facilities, 81 percent attempt to control trespass and 76 percent have regulations pertaining to "litterbugging." (Auth. abst.)

2666. Houser, Alfred, and Michel G. Bross. 1959. OBSERVATIONS ON GROWTH AND REPRODUCTION OF THE PADDLEFISH. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 50-52.

Young-of-the-year paddlefish collected from Fort Gibson Reservoir in 1957 grew to an average total length of 28.4 inches in the first year. A linear regression calculated for the first year of growth suggests that hatching occurred on May 4. Based on a review of the literature and observations made during general fisheries investigations on the reservoir for several years, it is suggested that paddlefish may have a periodicity in sexual maturation. (Auth. abst.)

2667. Riggs, Carl D., and Kermit E. Sneed. 1959. THE EFFECTS OF CONTROLLED SPAWNING AND GENETIC SELECTION ON THE FISH CULTURE OF THE FUTURE. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 53-57.

The role of controlled spawning, genetic selection and physiological research in fish culture is discussed, and emphasis is placed on the importance of these approaches for the future. A review of the literature is given. (Auth. abst.)

2668. Seymour, Allyn. 1959. EFFECTS OF TEMPERATURE UPON THE FORMATION OF VERTEBRAE AND FIN RAYS IN YOUNG CHINOOK SALMON. Transactions of the American Fisheries Society, Vol. 88, No. 1, pp. 58-69.

Experiments in each of three successive years were designed to observe the effect of temperature upon chinook salmon, Oncorhynchus tshawytscha (Walbaum), during the period from the egg to the fingerling stage. Experimental temperatures ranged from 35°F. to 74° F. but there were no survivals to the stage where vertebtae or fin rays could be counted for lots reared at temperatures below 39°F. or above 62°F.

For these experiments the average number of vertebrae per lot was less for lots reared at temperatures in the middle portion of the 39°F. to 62° F. range than for lots reared at either extreme of the range. The same effect was observed in regard to the numbers of rays in the anal and dorsal fins. The average numbers of vertebrae in the lots from the Sacramento River (California) and the three Washington rivers--Skagit, Green and Entiat--and reared at the same temperature (56°F.) were respectively 66.39 $\pm$ .047, 68.36 $\pm$ .052, 69.57 $\pm$ .23 and 71.73 $\pm$ .031. For all lots the range in number of vertebrae was 63 to 78. (Auth. abst.)

2669. Woodall, A. N. 1959. THE MISSING LINKS IN FISH HUSBANDRY. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 51-54.

Basic research in nutrition and disease, the application of these findings by pilot-plant studies, and a constant monitoring by quality control constitute a program of proved success in many animal husbandries. In fish husbandry the pilot-plant and quality-control programs are largely missing links. The responsibilities and interrelationship of these programs are discussed, and a combination pilot plant-quality control laboratory for fishery management is proposed. (Auth. abst.)

2670. Campbell, H. J. 1959. FIELD TESTING ROTARY FISH SCREENS IN NORTHEASTERN OREGON. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 55-62.

Bypass trapping over a 5-year period at 10 percent of the region's screen installations revealed tremendous annual savings in migrant salmonids. Rediversion of migrants through more than one screened irrigation ditch within the same stream occurred. Rotary screen efficiency was sampled under dissimilar situations. Population estimates of chinook salmon (Oncorhynchus tshawytscha) were made on the Imnaha River, utilizing marked migrants diverted and rediverted into irrigation canals. Diversion width and angle of take-off in relation to total migrants bypassed were tested independently for significant differences. Angle of take-off was more important than diversion size in relation to total numbers of fish diverted. Downstream migration peaks among smolt salmonids occurred in May, June, August, September, and October in 10 streams. (Auth. abst.)

2671. Combs, B. D., R. E. Burrows, and R. G. Bigej. 1959. THE EFFECT OF CONTROLLED LIGHT ON THE MATURATION OF ADULT BLUEBACK SALMON. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 63-69.

Experiments with controlled light on blueback salmon (Oncorhynchus nerka) have demonstrated the possibility of either delaying or accelerating sexual maturation by control of the daily light cycle. The acceleration of maturation from 14 to 19 days resulted in a significant increase in egg mortalities, but an increase in adult female survival during the holding period was indicated. Light was demonstrated to be dominant over temperature in the control of sexual maturation. (Auth. abst.)

2672. Hulsey, A. H., and James Stevenson. 1959. RECLAMATION OF LAKE HAMILTON, ARKANSAS. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 70-74.

A 3-year fishery study of Lake Hamilton revealed an unbalanced fish population with excessive numbers of gizzard shad (Dorosoma cepedianum LeSueur) and drum (Aplodinotus grunniens Rafinesque). Through a cooperative effort of the community and the

Arkansas Game and Fish Commission, 650,000 lbs. (estimated) of fish were selectively removed from the 7,200-acre lake by treatment with rotenone. Gizzard shad and drum formed the majority by weight of fish killed. Game-fish kill comprised approximately 1% of the total weight. The liquid rotenone was applied by gravity feed from 55-gallon drums mounted in motor boats. (Auth. abst.)

2673. Snow, J. R. 1959. NOTES ON THE PROPAGATION OF THE FLATHEAD CATFISH, PILODICTIS OLIVARIS (RAFINESQUE). Progressive Fish-Culturist, Vol. 21, No. 2, pp. 75-80.

Flathead catfish, Pilodictis olivaris (Raf.), were successfully spawned under hatchery conditions using the spawning-pen method used for channel catfish culture. Development of the embryos was observed in a sample of eggs transferred to the laboratory. Generally the development of flathead catfish eggs appeared to be similar to that of channel catfish. Difficulty was encountered in rearing the flathead catfish fry in a rearing trough supplied with pond water. The diet of finely ground liver was not too satisfactory. Heavy mortality occurred as a result of starvation, an infestation of Trichodina sp., and treatment of this parasite with formaldehyde. From a spawn of 9,947 fry, only 607 survived to an average length of 1 inch, or a size of 885 per pound. Though there is some indication that flathead catfish can be propagated under warm-water hatchery conditions, several problems must be solved before this species can be produced in appreciable numbers. (Auth. abst.)

2674. Macklin, Robert. 1959. AN IMPROVED 150-GALLON FISH-PLANTING TANK. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 81-85.

A new 150-gal. fish-planting tank with a carrying capacity of 450 to 500 lbs. of trout is described. Features of the tank and modified aspirator and spray system are diagrammed. The carrying capacity has been raised from 2.1 lbs. per gallon of water in the standard 150-gal. tank to 5.7 lbs. in the new tank. Tests indicate that rapid circulation without excessive turbulence is responsible for the increased carrying capacity. (Auth. abst.)

2675. Nielson, W. E., and J. J. Mazuranich. 1959. DRY DIETS FOR CHINOOK SALMON. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 86-88.

Seven diets were tested at the College of Fisheries, University of Washington, as starting feeds for chinook salmon. At the conclusion of 10 weeks' feeding, only the diets containing fresh liver proved to be satisfactory. A diet with fish meal plus 40% liver was superior to a diet of shrimp meal plus 40% liver. A nutritional deficiency and a high mortality developed among the fish on a diet of 50% fish meal and 50% shrimp meal, as well as among the fish on a diet composed of 100% fish meal. Three commercial dry fish diets tested proved unsatisfactory as starter feeds for chinook salmon. (R. R. R.)

2676. Irwin, W. H. 1959. TERRAMYCIN AS A CONTROL FOR FIN ROT IN FISHES. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 89-90.

Fin or tail rot, a bacterial disease in fishes, frequently kills fishes being held in pens. Often it is desirable to keep fish alive and confined for sale or experiments. In either case, fin rot can stop operations. Small quantities of terramycin (a few milligrams) placed in the water with the fish will cure severe cases or prevent infection. Contrary to reports and expectations, aureomycin and streptomycin failed to effect a cure. (W. H. I.)

2677. Chin, Edward. 1959. AN INEXPENSIVE RE-CIRCULATING SEA-WATER SYSTEM. Progressive Fish-Culturist, Vol. 21, No. 2, pp. 91-93.

A re-circulating sea-water system constructed entirely from relatively inert materials including many standard polyethylene items, such as a water pump, drain outlets, standpipes, and filtering units, is described. A simple method of waterproofing wooden tanks for use as aquaria with Fiberglas resin is also described. The system is inexpensive, easy to construct and maintain, and has been satisfactorily used as holding facilities for fish, shrimp, and other invertebrates. (E. C.)

2678. Templeton, W. L. 1958. FISSION PRODUCTS AND AQUATIC ORGANISMS. Paper presented at a Symposium on the Effects of Pollution on Living Material, held by the Institute of Biology in London, September 1958; Water Pollution Abstracts, Vol. 32, No. 4, Abst. No. 733. 1959.

The author describes the accumulation of radioactive isotopes by marine and freshwater organisms, and describes how, from a knowledge of the relations between concentration in sea water, in fish, and in seaweed, the maximum permissible rate of discharge of various isotopes can be assessed. Different species vary considerably in their ability to accumulate certain isotopes. The isotopes may be taken up in 3 ways--by adsorption on surface areas, by absorption from the water, and by ingestion as food. The work of various investigators is reviewed briefly.

2679. Bandt, H. J. 1957. THE TOXICITY OF WEED KILLERS TO FISH. Z. Fisch., No. 6, pp. 121-125; Water Pollution Abstracts, Vol. 32, No. 4, Abst. No. 743.

The author describes experiments on the toxicity of 10 commercial weed-killers to fish. Tables of results give the type of material, the maker's name, the type of fish used, the threshold value for toxicity, and the amount, in g per sq. m, required for the control of weeds in water.

2680. Reich, K., and M. Rotberg. 1958. SOME FACTORS INFLUENCING THE FORMATION OF TOXIN POISONOUS TO FISH IN BACTERIA-FREE CULTURES OF PRYMNESIUM. Bull. Res. Coun. Israel, 7B, pp. 199-202; Water Pollution Abstracts, Vol. 32, No. 4, Abst. No. 749. 1959.

The effect of various factors on the formation of

of a toxin by bacteria-free cultures of Prymnesium parvum was studied. It was found that more toxin was formed in 5 per cent sea water than in 30 per cent sea water; this confirms the fact that mass mortality of fish has been observed only in brackish water although Prymnesium also occurs in the sea. The addition of calcium to the culture also increased the amount of toxin formed.

2681. Tarzwell, C. M. 1958. AQUATIC BIOLOGICAL INVESTIGATION AS A METHOD OF EVALUATING THE SELF-PURIFICATION OF A STREAM. T. A. P. P. I., Vol. 21, No. 10, pp. 40A-59A; Water Pollution Abstracts, Vol. 32, No. 4, Abst. No. 751, 1959.

The author discusses the importance of biological surveys for studying self-purification of streams and the effect on stream biota of inert materials, putrescible wastes, toxic substances, heated discharges, and radioactive materials.

2682. Lawrence, J. M. 1958. METHODS FOR CONTROLLING AQUATIC WEEDS IN FISH PONDS WITH EMPHASIS ON USE OF CHEMICALS. Agric. Exp. Sta. Ala. Polyt. Inst., Progr. Rep. Ser. No. 69, 8 pp.; Water Pollution Abstracts, Vol. 32, No. 5, Abst. No. 816. 1959.

Information on methods for the control of the more objectionable water weeds is summarized in tabular form, with special reference to their application to fish ponds. The plants are considered in the following groups: plankton algae; filamentous algae; submerged weeds; emergent weeds; marginal weeds; and floating weeds. The methods mentioned are biological, mechanical, and, particularly, chemical. The effective concentration of various chemical compounds is tabulated, distinctions being made between the compounds recommended, those regarded as safe for use in ponds, and those on which further data are required. A summary is also given of the toxic effects of selected algicides and aquatic herbicides to fish and warm-blooded animals. A list of 36 references is appended.

2683. Ayers, J. C., D. V. Anderson, D. C. Chandler, and G. H. Lauff. 1956. CURRENTS AND WATER MASSES OF LAKE HURON. (1954 SYNOPTIC SURVEYS). Ont. Dep. Lds & Fors, Div. Res., Res. Rep. No. 36; Water Pollution Abstracts, Vol. 32, No. 5, Abst. No. 820. 1959.

Three synoptic surveys of lake Huron were made in the summer of 1954, more than 80 stations being occupied in each survey. At each station various measurements were made, including meteorological data, and the temperature, colour, and transparency of the water; drift bottles were released; and samples of surface and sub-surface water were collected for chemical analysis including determinations of magnesium, silicon, calcium, and conductivity. The physical and chemical data obtained are given in maps and tables, and discussed in relation to the inflow of water from lakes Michigan and Superior, the fundamental circulation pattern in the lake, and the thermocline which developed in July.

2684. Ebbinghaus, E. 1958. APPARATUS FOR RECORDING THE OXYGEN CONTENT OF WASTE WATERS. Wasserwirtschaft, No. 48, pp. 320-321; Water Pollution Abstracts, Vol. 32, No. 5, Abst. No. 828. 1959.

Difficulties arise in the use of electrochemical methods for measuring the oxygen content of river waters and waste waters because of uncontrollable variations in pollution. Suitable apparatus exists for measurement and recording the oxygen content of a gas and the author describes the use of this method for water. In principle the method depends on exchange between equal volumes of water and oxygen-free nitrogen. These are brought into contact in counter-current in a degasifying column and the oxygen content of the withdrawn gas is determined and recorded. The accuracy of the method and its use in practice are described.

2685. Bandt, H.-J. 1958. POISONED WATERS. Urania, No. 3; Water Pollution Abstracts, Vol. 32, No. 5, Abst. No. 947. 1959.

The author deals with the types of toxic materials which may reach water containing fish and gives, from the literature and from experience, figures for toxic pH values and toxic concentrations of iron, heavy metals, cyanides, detergents, and weed-killers.

2686. Adlung, K. G. 1958. TOXICITY OF DINITROCARBAZOLE TO FISH. Naturwissenschaften, 45, p. 631; Water Pollution Abstracts, Vol. 32, No. 5, Abst. No. 951. 1959.

Dinitrocarbazole is sprayed over forests as a dust containing 10 per cent active agent. Experiments with minnows showed that in still water, with movement at the surface, dust applied at the rate of 1.25 kg of dinitrocarbazole per ha caused slight damage in 8 hours and death in 16-20 hours; with 2.5 kg damage was caused in 7-8 hours and death in 12-15 hours; with 5.0 kg damage was evident in 4-5 hours and death was caused in 5-6 hours. The dust floated and dissolved slowly so that in flowing water the normal application of 50 kg of dust (5 kg dinitrocarbazole) per ha would not be likely to dissolve sufficiently rapidly to create a toxic concentration.

2687. Carritt, D. E., and J. W. Kanwisher. 1959. AN ELECTRODE SYSTEM FOR MEASURING DISSOLVED OXYGEN. Analyt. Chem., No. 31, pp. 5-9; Water Pollution Abstracts, Vol. 32, No. 6, Abst. No. 1034.

In the determination of dissolved oxygen by polarographic devices with solid electrodes, difficulty is experienced because of electrode poisoning and high temperature coefficient. A system has now been devised comprising a platinum electrode, a silver-silver oxide reference electrode, a thermistor which provides temperature compensation, 0.5 N potassium hydroxide as an internal electrolyte, and a polyethylene membrane pulled tightly over both electrodes. The membrane is permeable to dissolved molecular oxygen but much less so to other dissolved substances, and permits the passage of oxygen to the platinum electrode, where it is reduced to hydroxyl, but pre-

vents the passage of substances that would poison or change the characteristics of the electrode. The device has operated satisfactorily in sea water, fresh water, and sewage. Addition to the external environment of chlorine, hydrogen sulphide, acids, and bases had no measurable effect.

2688. Griffiths, V. S., and M. I. Jackman. 1959. AUTOMATIC POTENTIOMETRIC TITRATION IN DETERMINATION OF DISSOLVED OXYGEN. Analyt. Chem., 31, pp. 161-162; Water Pollution Abstracts, Vol. 32, No. 6, Abst. No. 1035. 1959.

Automatic apparatus has been developed for the titration with ferrous ammonium sulphate in the determination of dissolved oxygen. The titration is followed potentiometrically by using an electrode pair comprising a glass reference electrode and a platinum indicator electrode. A glass electrode was used as a reference as it introduces no extraneous ions into the solution, and it does not require replenishing.

2689. Hamon, B. V., and N. L. Brown. 1959. A TEMPERATURE-CHLORINITY-DEPTH-RECORDER FOR USE AT SEA. J. sci. Instrum., 35, pp. 452-458; Water Pollution Abstracts, Vol. 32, No. 6, Abst. No. 1040. 1959.

A detailed illustrated description is given of a temperature-chlorinity-depth recorder developed in Australia by the Division of Fisheries and Oceanography, of the Commonwealth Scientific and Industrial Research Organization, for use at sea.

2690. Anonymous. 1957. BIOLOGICAL PROBLEMS IN WATER POLLUTION. U. S. Dept. of Health, Education, and Welfare, 276 pp.; Water Pollution Abstracts, Vol. 32, No. 6, Abst. No. 1124. 1959

The text is given of papers presented at a seminar on biological problems in water pollution held at the Robert A. Taft Sanitary Engineering Centre, Cincinnati, Ohio, in April 1956. The papers dealt with the use and value of bio-assays, the use and value of biological indicators of pollution, current investigations on water pollution biology being carried out at different places, the training of aquatic sanitary biologists, and water quality criteria for aquatic life.

2691. Anonymous. 1958. HANFORD BIOLOGY RESEARCH. ANNUAL REPORT FOR 1957. HW-53500. Office of Technical Services, U. S. Dept. of Commerce, Washington, D. C., 228 pgs.

Work carried out at Hanford, Wash., during 1957 on the effects of radioactive isotopes on plants, animals, humans, and fish, is reported. It has been found that aquatic organisms accumulate caesium-137 in high concentrations, and this could constitute a hazard for man eating fish from water contaminated with caesium-137. Cereals were irrigated with effluent from the reactor, to study the uptake of isotopes by the plants. Little long-lived beta-emitting material was taken up by the plants, but zinc-65 and chromium-51 did accumulate in plants watered with undiluted effluent. Experiments were carried out on the temperature tolerance of eggs and young whitefish from the Columbia River. It was found that mortality increased with increase in temperature. The toxicity of trivalent and hexavalent chromium to salmon was also investigated. Hexavalent chromium in a concentration of 0.2 p.p.m. was definitely toxic, retarding rate of growth and resulting in increased mortality, while trivalent chromium in the same concentration had no observable effect.

2692. Long, Clifford W. 1959. PASSAGE OF SALMONOIDS THROUGH A DARKENED FISHWAY. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 300, 9 pgs.

An experiment to produce specific information on rate of ascent of salmonoids through a darkened fishway was conducted in a short, pool-and-overfall fishway without submerged orifices. The fish (98 percent steelhead - Salmo gairdneri) negotiated the 6-pool fishway significantly faster in near-total darkness than in light conditions approximating a bright, cloudy day. (Auth. abst.)

2693. Greenbank, John, and Philip R. Nelson. 1959. LIFE HISTORY OF THE THREESPINE STICKLEBACK GASTEROSTEUS ACULEATUS LINNAEUS IN KARLUK LAKE AND BARE LAKE, KODIAK ISLAND, ALASKA. U. S. Fish and Wildlife Service Fishery Bulletin 153, pp. 537-559.

The threespine stickleback occurs in large numbers in Karluk Lake, Kodiak Island, Alaska, an important water in studies of red salmon production. The life history of the stickleback in Karluk and Bare Lakes presents many interesting phases. It has a lifespan of about two-and-one-quarter years and in that period spawns once, or twice at the most. Structurally, the stickleback is hermaphroditic. It feeds on planktonic invertebrates and insect larvae. A possible interrelationship between stickleback and juvenile red salmon is that both consume the same kinds of food. Both species are preyed on by the Arctic charr. (Auth. abst.)

2694. Lander, Robert H. 1959. THE PROBLEM OF FISHWAY CAPACITY. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 301, 5 pgs.

The paper gives a rationale for studying the question of whether or not crowding obstructs the passage of fish through a fishway.

Average time spent in a fishway increases with numbers present if crowding hinders passage. Average usage time plotted on average number present (no delay from crowding assumed) yields the model. Capacity is reached where values of observations exceed those in the model.

Experimental data show, for a stable entry rate, a significant decrease in the relationship of exit rate, to numbers present. This is suggested as one way of detecting delay from crowding in a particular section; it requires only a single test.

It is difficult to measure the capacity of a large fishway. (Auth. abst.)

2695. Day, C. Godfrey. 1959. OCEANOGRAPHIC OBSERVATIONS, 1957, EAST COAST OF THE UNITED STATES. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 282, 123 pgs.

Daily water temperature and salinity observations from 1957 from sixteen locations along the Atlantic seaboard from Grand Manan to the Savannah Lightship are tabulated, plotted and discussed. This is the second consecutive year of synoptic observations allowing description of the annual temperature and salinity cycles of the east coast waters of the United States. (Auth. abst.)

2696. Moore, Harvey L. 1959. DOCTORAL DISSERTATIONS ON THE MANAGEMENT AND ECOLOGY OF FISHERIES, ADDITIONAL LISTINGS, 1952-55. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 272, 31 pgs.

In 1952 a revised listing of doctoral dissertations relating to the management and ecology of fish and fisheries was published as Special Scientific Report--Fisheries No. 87. This report covered the academic years from 1934 through 1950-51. The present report is a continuation of listings of dissertations covering the 4-year period from 1951-52 through 1954-55. (From auth. abst.)

2697. Royce, William F., Raymond J. Buller, and Ernest D. Premetz. 1959. DECLINE OF THE YELLOWTAIL FLOUNDER (LIMANDA FERRUGINEA). U. S. Fish and Wildlife Service Fishery Bulletin 146, pp. 169-267.

The yellowtail flounder fishery off New England was studied intensively from 1942 to 1949 to determine if changes in the yellowtail populations were related to fishing pressure and whether regulation of the fishery was necessary to conserve the species.

Tagging and other evidence indicated the existence of five stocks, the most important of which to United States fishermen occurred off southern New England. The landings from the southern New England stock declined from 63, 000, 000 pounds in 1942 to 10, 000, 000 pounds in 1949, but the population did not exhibit the usual symptoms of heavy fishing: a declining average size, an increasing proportion of young fish, or an increasing growth rate. Estimates of mortality and recruitment indicated that the fishery was drawing gradually on a reserve which for unknown reasons was not replenished by young.

There is no clear evidence that greater total production could have been achieved by protecting fish at any size, in any area, or at any time of year. (Auth. abst.)

2698. Day, Albert M., and Milo Moore. 1958. A REVIEW OF THE JAPANESE SALMON FISHERY. Oregon Fish Commission, Portland, Oregon, 26 pgs.

This paper is a resumé of observations of the authors while they served as advisors to the North Pacific Fisheries Commission in Tokyo during November 2-16, 1958. It covers the importance of the fisheries, the Tokyo fish market, the Hokkaido salmon hatchery system and its results, the extent of natural spawning on Hokkaido, and concludes with the statement, . . . "Of chief interest to American fishing interests is the fact that all of the sockeyes, cohos, and chinooks, and most of the pinks and chums are of non-Japanese origin. The sockeyes and pinks are of North American and Asiatic stocks but are caught by the Japanese fishery on the high seas. Herein lies the importance of international treaties to assure that sound management of the International salmon resource will be achieved."

2699. Kalinkin, S. A. 1958. THE TECHNIQUE IN CATCHING BALTIC SALMON. (TEKHNIKA LOVA BALTISKOGO LOSOSIA.) M., Rybnoe Khoziaistvo, No. 2, Feb., pp. 43-45.

According to biologist M. N. Lishev, the southern-Baltic race consists mainly of fast-growing large salmon which spend 3-4 years in the sea before they mature. This type salmon is found mostly along the entire southern Baltic, especially in the Barnholm Island. The salmon of this section migrate East and in February reach the Pionersk-Klaiped region. This salmon moves along the shores. Toward spring the commercial fishing section moves further east, and at the end of May and the beginning of June salmon catching ceases in this section. Fishing is concentrated usually at a distance of 6-8 miles from the shore.

The second, fairly large race, consists of smaller salmon which usually mature in the sea within one year. In spring, when sprats approach the shores, the small salmon are caught in stationary nets together with the sprats. This proves that there are ample possibilities for the production of salmon in the Kaliningrad area.

The nets for drift catching of salmon in the Baltic Sea are 27. 5 m long and 6-6. 5 m high. The most used nets are made of flax-hemp with 80-100 mm mesh. Salmon catches are still low and do not exceed 0. 6-08 kg. to a net. For mass catches of salmon in the Baltic, the trade needs broader scientific knowledge. Information on salmon habits and behavior during all seasons of the year is necessary and would establish efficient catches and promote business.

Drift catches of salmon often keep fishermen from engaging in the trade because it is not remunerative enough. In spite of the comparatively high price of salmon, the fisherman engaged in it has a lower income than his associate in the cod or sprats trade. And the intensive trade of the latter coincides with the favorable period for salmon catching.

We should seriously consider the possibility and encourage fishermen in mass salmon catching. (R. G. K.)

2700. Butskaia, N. A. 1958. EXPERIMENTAL FACTS ON STURGEON BREEDING ON THE AGRAKHAN GULF. (EKSPERIMENTAL'NYE

OBOSNOVANIIA OSETROVODSTVA NA AGRAKHANSKOM ZALIVE.) M., Rybnoe Khoziaistvo, No. 2, Feb., pp. 24-25.

A temporary sturgeon center was set up in the spring of 1957 on the Agrakhan Gulf, 5 km below the settlement. Breeders were caught within 6 days, May 31-June 5, with stationary nets. These breeders were housed in a wooden fish-pond 190x200 cm. The water depth in the pond was 60-70 cm.

Five males and six females were caught. One male and one female proved undesirable. The others, injected, developed normally within 22-29 hours. Kept at temperatures of 15-26°, the sperm was of good quality and one gram of roe had 75, 80, 84, and 88 eggs (standard is 82).

The roe was fertilized with mixed sperm of two males. The percentage of the roe developed was 83, 74, 71, 66. The roe was incubated in a Chalikov apparatus. There was hardly any current, there were large daily fluctuations, the water temperature was about 10°, there were frequent winds and waves - all this served to cloud the water and to inhibit incubation. The roe from two females was successfully incubated to the larvae stage.

In spite of such unfavorable conditions, more than 130 thousand larvae were obtained and introduced into the bay on a sandy bottom.

The results of the experiments proved that it is possible to raise sturgeon in the Agrakhan region. Since the fish could not enter the Terek River, they would have perished or survived without spawning. It is, therefore, advisable to transfer the Terek breeders to artificially constructed ponds. Breeding them under desired conditions, it is possible to secure a normal, healthy race. A modern sturgeon plant should be erected on the Agrakhan Gulf, on the basis conducted along the Volga, Kura and Don Rivers. (R. G. K.)

2701. Danil'chenko, O. P. 1958. PENETRATION OF RADIOACTIVE STRONTIUM-90 FROM THE WATER INTO THE BODY OF THE FISH. (PRONIKNOVENIE RADIO-AKTIVNOGO STRONTSIIA-90 IZ VODY V ORGANIZM RYBY.) M., Rybnoe Khoziaistvo, No. 2, Feb., pp. 28-32.

Strontium-90 enters the animal body, settles in the skeletal structure and replaces calcium. The result is strontium rickets which is not cured by vitamin D. Strontium-90 is deposited in large doses in animals who have been on a low calcium diet.

The present study, under the direction of Prof. G. S. Karzinkin, concerns (1) what degree of strontium concentration is necessary in the water in order to penetrate the body of the fish, (2) the path of strontium penetration, and (3) how long does this microelement remain in the body of the fish.

Sturgeon and carp of the year's crop were kept in radioactive water for one hour. Then they were transferred to an aquarium with running water - a strong current for the first 24 hours. Sturgeon of the 5-6 grams weight remained in this water for one hour.

Checking surface radioactivity of the tested fish, it has been found that increased concentration of the radioactive substance in water increases its penetration in the organs of the fish. Also, that sturgeon kept in radioactive water absorbs strontium-90 through the stomach, gills and skin. The entire intestinal tract showed radioactivity immediately after the fish were taken from the radioactive solution. Radioactivity penetrates through the mouth cavity, but it is not absorbed by the mucous membrane of the mouth. The front part of the stomach had the highest count of strontium-90 the first day, but on subsequent days, after the fish had been in radioactive-free water, radioactivity subsided and disappeared from the stomach. Thus strontium-90 is not absorbed by the front or back part of the stomach. Strontium-90 was retained longest in the central part of the stomach, which proves that it is absorbed by the small intestines. It is the gills which retain the radioactive isotope brought by the blood, and they themselves take radioactivity from the water and transmit it to the body of the fish.

Small sturgeon, 5-6 grams, were tested for skin radioactivity, since such size sturgeon have no scales. Skin radioactivity was evident only in the first analysis and immediately after the fish were removed from the radioactive water. Radioactivity from the skin penetrates the body. The radioactivity content of the skull was six times as high as in the fins, and strontium-90 concentration gradually increased in the bone tissue.

The surface radioactivity of carp, kept in radioactive water then washed in clean water, showed radioactivity ten times as high as in the sturgeon. This radioactivity diminished considerably within the first two days.

The unusually high content of radioactivity in carp is due to the compact scale-covering which absorbs and retains a greater degree of radioactivity and which proves more difficult to remove by washing. After eleven days the radioactive substance was eliminated from the surface covering of the carp as well as the sturgeon.

Thus, radioactive strontium-90 penetrates the body of the fish directly from the water through the mouth orifice, gills and skin. The absorbed radioactive substance gradually concentrates in the bony element. With sturgeon this process is evident during the first few days, with carp it takes much longer.

Regardless of high radioactivity of the water and of high energy radiation of strontium-90 - Y^{90}, fish kept in a radioactive solution of this substance have comparatively low radioactivity. (R. G. K.)

2702. Deeva, T. A. 1957. USING GREEN AQUATIC PLANTS AS ADDITION TO FOOD FOR THE YEAR'S CROP. (PRIMENENIE ZELENOI VODNOI RASTITEL'NOSTI KAK DOBAVOK K KORMAM PRI VYRASHCHIVANII SEGOLETKOV.) M., Rybnaia Promyshlennost', No. 34, pp. 55-63.

Food mixtures lacking essential nourishing elements can be compensated by the addition of green aquatic plants. Besides fats, protein and carbohydrates, these contain also vitamins, mineral salts and microelements.

Experiments during the past few years have shown that vitamins in the fish diet contribute to increased metabolism, aid assimilation of artificial foods, and render fish resistant to disease. Aquatic plants contain also secretin (vegetable hormone) which stimulates the flow of pancreatic juice.

In 1956, V. A. Pegel established that in fish without stomachs, the introduction of secretin from aquatic plants (not terrestrial) isolates digestive juices.

Again in 1956, experiments were conducted in nursing ponds, where the fish were fed a mixed diet of 50% cottonseed cake, 20% ground wheat, 10% fish meal, 5% corn, 10% chrysalis, 5% flour, 2% chalk. The protein ratio was 1:2.2. Twenty percent and thirty percent of freshly prepared green aquatic plants were added to the test pond. These plants were prepared 3-4 hours before feeding. Preparing the plants 5 hours before feeding causes fermentation and loss of vitamins. When aquatic plants used in summer were not available in winter, carrots and beet greens were used.

It has been established that the addition of 30% of green aquatic plants to the food ration insures intensive growth, and renders the fish resistant to disease and to winter cold.

Economically, 30% of the total weight of food invested in green aquatic plants brings an average saving of 11.6%. (R. G. K.)

2703. Dvinin, P. A. 1958. NEW DATA ON THE MIGRATION OF HUMPBACK SALMON IN THE SAKHALIN REGION. (NOVYE DANNYE O MIGRATSIIAKH GORBUSHI, ONCORHYNCHUS GORBUSCHA WALBAUM, V RAIONE SAKHALINA.) M., Rybnoe Khoziaistvo, No. 1, Jan., pp. 12-16.

The most probable path of humpback salmon migration is as follows:

A certain part of the salmon of the eastern Sakhalin population, in its earlier course, or simultaneously with the Amur group, or a little later (depending on the catch with hooks used in the Pacific), goes through the Friz Strait and avoiding the southern part of the Okhotsk Sea penetrates La Perouse Strait, the southern part of Tartar Strait, where the fish fatten for a while, then approaches the southwestern Sakhalin coast.

After fattening, the salmon leave this area and go to their native rivers; partly into Aniwa tributaries and the East-Sakhalin coast, partly north to the Amur River estuary, and a small number goes into the rivers of the western coast. This corresponds with the data of the recorded course, since the movement at the southwest Sakhalin coast begins earlier (early June), in the Amur estuary it starts later in June, and in the Aniwa Bay the movement is almost simultaneous or a little later than on the southwest coast, and on the eastern coast the movement takes place in the second half of June.

Furthermore, the greater part of humpback salmon of the East-Sakhalin group migrates in July-August from the Pacific through the Friz Strait directly to the spawning rivers of the East-Sakhalin coast and into the rivers of Aniwa Bay, particularly its west coast.

The local, small, West-Sakhalin group does not go far from the southwest Sakhalin coast and probably winters in the southern part of the Tartar Strait, or in the northern part of the Japanese Sea. This conclusion is substantiated by the annual late-fall catches of the year's salmon crop, averaging 23 mm in length in the southwestern Sakhalin coast. In some cases humpback salmon were caught in November in herring nets, 1 1/2 miles from the southwest coast. At the same time, catches of two-year old Oncorhynchus masu, January 22 and February 16, 1957, at the southwest Sakhalin coast, at a depth of 40-60 m and within 3-5 miles from the coast, show that O. masu of the local West-Sakhalin group winters close to these shores.

In 1956, the Research Institute of George Washington University carried out markings on Far Eastern salmon, north and south of the Aleutian Islands, west of Adak and probably beyond 175° of the eastern longitude. In August, 1956, several cases were recorded in Aniwa Bay with American markings.

Catches of individually marked humpback salmon proved that part of the eastern Sakhalin population fatten in the northwestern section of the Pacific. (The main part of the group, as is known, winters in the Pacific, southwestward of Hokkaido). (R. G. K.)

2704. Faktorovich, K. A. 1956. DISEASES OF TWO-YEAR-OLD RAINBOW TROUT REARED ON ARTIFICIAL FOODS. (ZABOLEVANIIA DVUKHLETOK RADUZHNOI FORELI PRI VYRASHCHIVANII NA ISKUSSTVENNYKH KORMAKH.) M., Voprosy Ikhtiologii, No. 6, pp. 156-163.

Analyzing the diseases of rainbow trout, it has been found that basic pathological changes occur in the liver. Plen and Goschatt are of the opinion that disorders of the digestive tract do not always accompany liver disease.

Fat increase in the liver cells, when it becomes degenerative, impairs the cells so that they can no longer assimilate fat, and in progressive cases the liver ceases to function.

Plen states that normally the liver of rainbow trout does not contain labile (unstable) fat, and that any fat present in the liver can be considered pathological. But fat deposit in the liver is natural with all vertebrates and cannot be accepted as a pathological phenomenon in rainbow trout. In the present experiment, rainbow trout raised on natural foods did not have any labile fat in its liver, in spite of the fact that it had a large deposit of fat in the omentum, whereas trout reared on poor artificial food had a considerable quantity of soluble fat in the liver. The presence of insoluble fat in the liver of rainbow trout bespeaks a pathological process. Evaluating foods as the basic cause of this pathological condition has been suggested.

Vitamin deficiency is of first importance. Plen pointed out that the addition of natural food to the diet of rainbow trout improves digestion and diminishes danger of illness, based on the theory that digestive ferments are lacking. N. V. Puchkov refutes this

theory and proves experimentally that the stimulating agents are not the added ferments but the vitamins. Hempel and Goschatt point out that vitamin deficiency and monotony of food cause illness in fish. L. M. Nusenbaum and N. V. Guseva claim that the liver of a sick trout lacks vitamin A entirely, whereas the content of this vitamin in the liver of a healthy fish, but one reared on artificial food, is drastically reduced. And again, that damage of liver tissue is connected with vitamin A deficiency.

The equally important reason for illness of rainbow trout is the inadequacy of artificial foods. Illness and death of fish are also ascribed to meat and blood flour. Poor quality fish meal in combination with 40-60% of bran or malt shoots cause death because of vitamin deficiency.

Fresh and well-prepared animal meal is a valuable albumen product. Hofer pointed out that all forms of animal meal, designed as food for fish, must be prepared from absolutely fresh raw stock, for further thermal processing renders harmless the putrid bacteria but not the toxins they produce. Processing stale stock at high temperatures renders albumen less digestible, and this alone can be reason for illness. Also, that fish meal should be prepared from lean fish; meal from fat fish, stored even for a short time, becomes rancid and unfit for food. In general, storage of all animal meal should be strictly limited. The product should be kept in glass or metal tare without access of air.

All food forms should contain not more than 1.5% of salt. Hofer and Plen show that salt poisoning causes reddening of and has a corroding effect on the mucous membrane of the entire digestive tract.

It is unanimously agreed that one reason for excess fat in trout is overfeeding. Plen points out that, when overfed, rainbow trout loses much of its natural instincts and cannot itself regulate its food intake. The "loss of instincts" is again a symptom of a pathologic disturbance caused by vitamin deficiency and physiologically inadequate food.

In artificial feeding fish gain weight fast, and the larger and best fed are the first to succumb. Goschatt emphasizes the danger of overfeeding in winter, and he suggests feeding fish less during the cold months. But this is not applicable, for it would limit the possibility of rearing two-year-old commercial trout. Rainbow trout should be fed also in winter. But winter rations should be carefully prepared and they should consist of easily assimilated food. Food for rainbow trout can be cheap but it must be nourishing and physiologically adequate.

The observations on rainbow trout, conducted during the summer of 1953, permit us to establish that fish perished as the result of fat degeneration and disintegration of liver cells, and that the reason for disease and death is vitamin deficiency and poorly assimilated low-quality foods. (R. G. K.)

2705. Galina, N. V., E. F. Martinson, and V. IA. Redikson. 1958. ON THE BIOTECHNIQUE IN ARTIFICIAL BREEDING OF PIKE. (O BIOTEKHNIKE ISKUSSTVENNOGO RAZVEDENIIA SHCHUKI.) M., Rybnoe Khoziaistvo, N. 2, Feb., pp. 26-28.

Since 1956, experiments have been carried out on artificial breeding of pike and on the possibility of transporting fertilized roe. The present experiment was conducted during April-May on Lake Chudskoe, at the mouth of Emaiyaga River.

Pike were caught in nets and kept in wooden fish-ponds 3.0 x 1.5 x 1 m which were set in the river. The length of breeders used were: females 50-60 cm, males 40-55 cm. Density of the ponds was: 20 individuals/m. Conditions were good and there was no loss. Based on our experimental data, the following recommendations are offered:

To obtain pike roe, use breeders directly from the haul or from those held only temporarily in custody. To keep breeders, use ordinary wooden fish-ponds set in the river. The density of the wooden-pond population should be 15-20 individ/m^3, taking the average length of breeders at 45-65 cm.

For propagation purposes only healthy breeders should be used. Males and females should be kept together, but with the approach of the spawning period they should be placed in separate ponds. Pike roe should be collected in an enamel dish with absolutely smooth surface. Only one liter of roe should be placed in a pan 40 cm in diam.

The ratio of sexes for the fertilization of the roe is approximately 1:1. Roe fertilization, removal of mucus, and keeping the roe during swelling should be carried out very carefully. Roe swelling proceeds in not less than 2-3 hours. The roe layer, while kept in the dish, should be not more than 3 cm. The water layer over the roe should be 10-20 cm.

Pike roe can be transferred on ordinary transporting frames, stacked in isothermic boxes. The roe should be arranged on the frames in 2-3 layers only. When the roe is kept in moist atmosphere and when it is in transportation, the surrounding medium should be not higher than 8°. The roe is to be kept in moist atmosphere not longer than 3-5 days. It should be watered if it is not possible to irrigate the frames.

It is best to incubate pike roe in the Weiss apparatus: 2 lit. of roe in an apparatus with the capacity of 5-6 liter. Before it is hatched, the larvae is to be transferred to the gutter where they are kept until ready. Before they are released, the larvae should be 5-6 days old. (R. G. K.)

2706. Lagunov, I. I., and V. V. Azbelev. 1958. ON THE CONDITION OF THE TULOMA SALMON STOCK IN CONNECTION WITH THE WORK IN THE FISHERY ON THE TULOMA RIVER. (O SOSTOIANII TULOMSKOGO STADA SEMGI V SVIAZI S RABOTOI RYBOKHODA NA REKE TULOME.) M., Rybnoe Khoziaistvo, No. 5, May, pp. 16-19.

Before the construction of the hydroelectric station and the dam, Salmo salar L. spawned in the Tuloma River and its tributaries. Almost the entire spawning area in the main river has been inundated by the reservoir.

To permit the salmon to pass to the spawning grounds, a ladder-like passage, with 57 pools, was constructed. Wooden fish ponds, established in the

upper section of the ladder, permit the calculation of the number of fish going through this passage.

Before approaching the fishway, salmon are caught by the current from the waterfall, so that the period of their entry into the river, especially at high water, is delayed. The salmon surmount the fish passage without difficulty, but large ones lose some of their scales.

The salmon race of the Tuloma River is a special one and is not to be confused with the neighboring Kola group. The age of the Tuloma salmon group is fairly constant.

Data show that, in spite of the hydroelectric station, regardless of change in migration paths and descent, and in spite of the new spawning grounds, the size of the salmon race has not changed. This may be ascribed to favorable conditions of spawning, to the rearing of young in river tributaries, and to the care in safeguarding breeders.

The average fecundity of the Tuloma female is 10,400 eggs, sex ratio is 1:1, coefficient of survival is 1:427, or above 0.08%.

Observations showed that annually a large population of salmon is detained in front of the hydroelectric station, sometimes lingering until the middle of August. This is not normal, for in the adjacent Kola River the descent is completed by July.

It can thus be stated that, in cases where the natural regime of tributaries of the controlled river is not disturbed, the size of the fishery is not diminished. In individual cases, it is necessary to construct fishways and safeguard the descent of the young back to the sea. (R. G. K.)

2707. Nikiforov, N. D. 1958. ON SALMON REPRODUCTION. (O VOSPROIZVODSTVE SEMGI.) M., Rybnoe Khoziaistvo, No. 5, May, pp. 19-20.

In the North, salmon increase is connected chiefly with the natural propagation of the fish in the rivers.

Data of the 1954-1956 expedition showed that the spawning section of the Kola coast was limited. The passage of salmon breeders to the spawning grounds is made difficult by strong waterfalls and other obstructions located near river estuaries. The rivers of the Murmansk region are particularly in need of improvement. Of the 50 rivers in the Kola Peninsula, 19 have insurmountable barriers for salmon breeders. To remedy the situation, stage-like fish passages should be constructed.

The best method of rearing young salmon is in ponds. At each fishery station there should be sufficient pond area to accommodate the young and to insure stock restoration of the given salmon race. Ponds designed for rearing young salmon should be prepared beforehand. Predatory and mud fish should be eliminated from the lake. Mineral fertilizer should be introduced to improve the feeding base.

Fisheries often admit large quantities of young fish into small rivers or into tributaries of the main salmon river. This method has been found impractical, for the young in the river are eaten by predatory fish.

Releasing young salmon must be under uniform control. It should be on shore area, 1-2 larvae to 1 m^2, at a depth of 0.3-1 m. and on a stone-gravel bottom.

It is also essential to catch throughout the year, especially during salmon reproduction, all mud and predatory fish in the spawning rivers; to destroy the spawning section of such fish, and to collect their roe. (R. G. K.)

2708. Ponomareva, L. A. 1958. SPAWNING POPULATION OF EUPHAUSIIDAE AT THE SOUTHWEST SAKHALIN COAST. (NERESTOVYE SKOPLENIIA EUFAUZIID U IUGO-ZAPADNOGO POBEREZH'IA SAKHALINA.) M., Rybnoe Khoziaistvo, No. 4, April, pp. 10-12.

Most forms of planktonic crustaceans have been studied and are well known. But little is known of the biology of euphausiidae, although these are important in the food of whale and plankton-eating fish.

Euphausiidae are small, 25-33mm long, yellowish with red spots. Most of them live at depth of 500-1000m. They are widespread from the Arctic to the Antarctic. They cannot tolerate low salinity and cannot live in the Caspian, Black, Azov, and Baltic Seas. Euphausiidae do not inhabit shores or mud waters.

Euphausiidae are found in temperate zones of both hemispheres. Tropical waters have few of them in number, but the forms found there are quite varied. Mature euphausiidae feed chiefly on zooplankton of all forms, and in addition, are filter feeders.

They remain in deep water during the day and migrate to the surface at night, live about two years, and lay eggs once or twice a year. During spawning, the adults come to the surface in large groups visible for several days. Final maturity of female sex products does not proceed simultaneously, and not all of the females spawn at the same time. Their eggs are found from April to August in various seas. Euphausiidae spread in groups for several kilometers and hundreds of meters wide and can be seen from an aeroplane 300-500 meters high. (R. G. K.)

2709. Popov, K. I. 1958. ON MEASURES OF INCREASING THE STOCK OF FAR-EASTERN SALMON. (O MERAKH PO UVELICHENIIU ZAPASOV DAL'NEVOSTOCHNYKH LOSOSEI. M., Rybnoe Khoziaistvo, No. 8, August, pp. 9-10.

Large salmon groups enter the rivers of the Okhotsk coast, and they are said to be inexhaustible.

The Okhotsk River falls into the northwest part of the Okhotsk Sea, and has a hydrologic regime of mountain rivers. During the year the river has two floods: the spring flood and the summer-fall flood, which is longer and more abundant in water.

Rivers of the Okhotsk coast do not need artificial food bases; they are well provided with natural food. Predation, however, is an important problem.

Salvelinus malma consume salmon roe and the young salmon. During spawning, malma also eats Okhotsk herring and its roe. After spawning, malma concentrate in deep places of the main river channel and winter there. Mature malma (over 250 grams)

are estimated to number in the millions in the Okhotsk River alone. A dissected Okhotsk malma had 170 young keta and humpback salmon. Malma thus destroys millions of young salmon in one season.

The most favorable period for malma trade is the end of April through June. As malma are caught at large distances from commercial centers, there is the problem of transportation and processing.

It has been found expedient to create on the rivers of the Okhotsk area small processing bases with preservation and cooling systems. Malma is rich in fat, which tends to oxidize when kept long, so it should be frozen at once.

Organizing and developing more bases of this type will bring large returns in fish economy. It will also permit the survival of keta and humpback salmon, and will insure the return of these fish to their native rivers in the Okhotsk area. (R. G. K.)

2710. Rudakov, N. P. 1958. COMPARATIVE ABSORPTION OF CALCIUM-45 AND STRONTIUM-90 BY YOUNG SALMON. (SRAVNITEL'NOE POGLOSHCHENIE KAL'TSIIA-45 I STRONTSIIA-90 MAL'KAMI LOSOSIA.) M., Rybnoe Khoziaistvo, No. 4, April, pp. 19-20.

Young salmon, weighing 452 milligrammes, were placed for six hours in a radioactive solution of calcium-45 C12 and of strontium-90 C12. These solutions contained equal amounts by weight of each substance, as radioactive strontium is absorbed about 100 times faster than calcium due to its greater weight. Every hour the young were withdrawn from the solution to check the radioactivity. Other specimens following exposure were transferred for four days into dechlorinated water and checked for radioactivity reduction.

Data prove that the fish absorbed calcium and strontium with the same intensity from solutions with equal weight ratio of calcium and strontium.

After having remained in the dechlorinated water for some time, the fish showed considerably diminished radioactivity. Strontium radioactivity is absorbed by young salmon in minute quantities; the main part of it is quickly eliminated from the body of the fish. (R. G. K.)

2711. Bogatova, I. B., and M. K. Askerov. 1958. TEST ON COMMERCIAL CULTIVATION OF DAPHNIA MAGNA. (OPYT PROIZVODSTVENNOGO KUL'TIVIROVANIIA DAFNII.) M., Rybnoe Khoziaistvo, No. 12, Dec., pp. 21-26.

Attempts have been made in Russia and abroad to cultivate Cladocera on a large scale, but efforts have been in vain. Cladocera has been successfully produced only under laboratory conditions and on a small scale.

It has been possible to raise Daphnia magna on a large scale. During April-November, 1955, Daphnia was cultivated in cement basins, at the Kurinsk Experimental Station of the sturgeon fishery.

To fertilize the culture, horse manure, yeast, and mineral fertilizers were used.

It has been found that the highest oxygen content and highest oxidation were in basins fertilized with manure. In cultures on mineral fertilizer, oxygen content in water was invariably high and oxidation low; similar figures were obtained in cultures on yeast with mineral fertilizer.

The chlorine content of various cultures was close, and in fall fluctuated between 125-137.4 mg/liter. A higher chlorine content is characteristic for this section because of salty soils.

Best results and higher yields were obtained from cultures on yeast and ammonium fertilizer, without superphosphate.

Exploitation of basins was 20-30 days. The removal of the product began on the 12th day after loading. Higher production occurred in basins where larger charges of Daphnia were introduced. Higher Daphnia charges also shortened the maturing period of culture, and Daphnia quality is better.

In removal of the culture from the basins, large Daphnia are removed, and the young are left to grow and add to the biomass, offering the possibility of further harvest.

In 1955, 2403.18 kg of Daphnia were removed; in 1956, 2655.8 kg; and in 1957, 2922.81 kg. With improved organization and development, Daphnia production can be still higher. (R. G. K.)

2712. Ignat'eva, G. M. 1958. ON CONDITIONS OF HARMONIOUS HATCHING IN INCUBATION OF STURGEON ROE. (OB USLOVIIAKH DRUZHNOGO VYKLEVA PRI INKUBATSII IKRY OSETROVYKH.) M., Rybnoe Khoziaistvo, No. 3, March, pp. 20-25.

In sturgeon, as in other egg-laying fish, embryo hatching is aided by the so-called hatching ferment discharged by the embryo. This ferment is discharged not at once, as in bony fish, but gradually.

Tests, to determine the influence of artificially induced vibration on hatching uniformity of sturgeon embryoes, show that vibration results in a greater percentage hatching in a briefer period. Vibration of embryoes long before the beginning of hatching did not cause early hatching. Aeration of water, and water current both contributed to more uniform hatching. The main function of vibration is direct irritation of the hatching gland, causing thereby embryo movement, which in turn leads to more energetic discharge of the ferment and better mixing of the liquids. (R. G. K.)

2713. Pisarenkova, A. S. 1958. STORAGE AND TRANSPORTATION OF SPERM OF RAINBOW TROUT AND PIKE. (KHRANENIE I TRANSPORTIROVKA SPERMY RADUZHNOI FORELI I SHCHUKI.) M., Rybnaia Promyshlennost', No. 34, pp. 47-50.

In April, 1952, the roe of trout in a fishery of the Belgorod region was fertilized with the sperm from males of the Leningrad area fishery. Diluents were added to the sperm to prolong its active movement. These diluents are standards established by the Research Institute on Cattle Breeding and are used for storage and transportation of sperm of warm-blooded animals. Then roe was obtained from rainbow trout of the Leningrad area fishery and fertilized with the milt of one male.

In the first batch fertilization was carried out

with sperm without diluents. In the second group, the diluent added to the sperm was in proportion of 1:3. In both cases the roe was fertilized by the usual "dry" method.

After 3-hours' swelling, the fertilized and washed roe was arranged on frames which were stacked in piles and wrapped in paper. The roe was on the road 17-18 hours, 2 days (April 18-19). For further incubation the roe was placed in the California Apparatus, established in the Savvin Experimental fishery VNIPRKH. The yield of larvae in roe incubation of rainbow trout was higher in the second group.

The sperm was filtered into dry, sterile bottles, on penicillin, and sealed with cork stoppers. Each bottle contained the sperm of one male. The sperm of ten males was transported. Diluents were added to the sperm of five males. The temperature was maintained at about 0°, for which purpose the thermos was kept in finely-crushed ice.

The sperm was examined under the microscope when taken, then after 68-hours storage and again at fertilization of the roe (115-hour storage). The period of sperm activity was found to be 55-60 seconds. After 68-hours storage, the sperm without the diluent showed activity movement of 35-40 seconds; those with the diluent displayed activity of 25 seconds. Additional tests on prolonged storage showed different activity values.

Fertilization percentage was higher in roe with the sperm of males from the Belgorod fisheries. Yet, the survival of larvae from roe fertilized with the sperm of the Leningrad fisheries was 7% higher than those fertilized with the sperm of males from the Belgorod section. Similar tests were carried out on the sperm of pike.

It has been found: (1) that the sperm of rainbow trout and pike has a fertilization capacity of four days and longer; (2) that the addition of diluents to the sperm prolongs the period of its active movement. The best results are obtained with the addition of diluents and, when the sperm is used for fertilization, immediately after it has been extracted; (3) that prolonged storage of the sperm with the diluent shortens the period of its active movement; (4) that a more stable race is obtained when trout roe is fertilized with the sperm of males reared in various geographical zones; (5) that the renewal of blood of trout breeders for a more vital race can be achieved by transporting the desired sperm. This process is more convenient and cheaper than transporting the breeders from one fishery to another. (R. G. K.)

2714. Lazarev, M. S. 1958. ACCLIMATIZATION OF FAR-EASTERN SALMON IN THE BASIN OF THE BERING SEA. (RABOTY PO AKKLIMATIZATSII DAL'NEVOSTOCHNYKH LOSOSEI V BASSEINE BARENTSEVA MORIA.) M., Khoziaistvo, No. 2, Feb., pp. 20-22.

The roe (7285 thousand) of summer keta was transported from the Amur River to the Onega fishery and 2339 thousand of the same roe to the Taibol fishery (Kola River). After incubation, the larvae obtained comprised 6,801 thousand in the Onega fishery and 2,129 thousand in the Taibol fishery, but there were no positive results of salmon acclimatization.

Several years ago V. A. Bodanova gave the reason why O. keta roe perished in incubation while the roe of humpback-salmon gave good results under the same conditions. Upon checking, it was found that the temperature of the water entering the incubator from the river was as low as + 0.2. At such temperature the incubation of humpback-salmon proceeds normally, whereas keta roe dies. This is substantiated also by the natural spawning conditions. Humpback-salmon spawn on shallow banks, but keta spawn in outgoing warmer subsoil waters.

The northern seas of European Russia, especially the Murmansk region, are poor in valuable commercial fish, but they prove fine spawning grounds for salmon. The most valuable commercial fish in the Kola Peninsula is Salmo salar. This fish does not spawn on shallow banks, so that there is no competition in spawning grounds between Salmo salar and humpback-salmon. Competition in feeding between the young of these species is also excluded, since the young of Salmo salar stay in the river until they are three years old, while the young of humpback-salmon drop down near the river estuary directly from the spawning ground.

The Central Acclimatization-Breeding Station decided to introduce not the roe of keta but the roe of humpback-salmon and not from large rivers, such as the Amur, but from small Sakhalin rivers which in their hydrological regime are similar to the rivers of the Kola Peninsula.

In 1956, the method of transporting humpback-salmon roe was based on eye pigmentation, and with layers up to 35 cm. The roe was in transit from Sakhalin to Murmansk six days. For experimental purposes, keta roe was taken immediately after fertilization and placed in a box and a 30 cm layer. Roe loss during transportation was 28%. This loss was due to the free space between the roe and the cover of the box. The roe, moving readily, was shaken up and damaged, but only eggs of the upper layer were injured; there was no loss in the lower and more compact layers. Transportation of roe in such boxes from one fishery to another give excellent results.

During incubation, all keta roe perished. Humpback-salmon roe from Sakhalin was sent by aeroplane in two shipments. The first shipment was sent with ice for cooling and moistening the roe, for the temperature during transportation was high. The second shipment was sent at the end of October, when the temperature through the trip was below zero. When the heat was turned on in the plane during the flight and the air in the chamber became dry, the roe had to be watered twice daily.

A total of 4037 thousand humpback-salmon eggs were transported to Taibol'. The total loss, from the beginning of the transportation was 7%; 3200 thousand fry were released into the river.

The young of humpback-salmon of the first shipment were released in May, those of the second

shipment were released in June. At the end of July, the humpback-salmon young up to 8 cm were caught at the estuary of the Kola River. (R. G. K.)

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